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HYDRO-PSYCHOSES.

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In this study we wish to investigate the influence that water has exerted in shaping and moulding man's psychic organism. The thoughts expressed in literature have been greatly influenced by pelagic conditions. Not only are there accounts of water spirits, nautical tales, etc., but almost every page bears evidence through metaphor of the modifications of thought and expression by water. Note the phrases "stemming the tide," "current of thought," "flowing robes," "torrents of joy," "a total wreck," "drown grief," "sinking in adversity," "ebbing life," etc. The poets have been especially inspired by the sea, the brook, the rill, etc. Many of the poems relating to water have been set to music, and have played a great rôle in religious worship. Hymnology is replete with allusions to water. What is now poetical allusion was in primitive times the expressions of belief. The poetry of to-day was the philosophy of yesterday. So, too, mythology chronicles as mere tales former firm beliefs. In this we find abundant evidence of the great influence water exerted upon savage peoples. Nearly all primitive peoples had their water spirits, and even the rivers and seas were supposed to be alive. The literature of all nations abounds with tales of fountains of youth, rivers of life, etc. Omens, superstitions, sayings relating to water and to water gods are numerous. Philosophy, religion, medicine, mythology, have all been influenced by various ideas concerning water.

Besides the foregoing, all people have feelings about water which are only partially explainable by present relations and circumstances. Much may be explained by the vastness, the activity, the feeling of, individual experiences, etc., but there

is still a residuum wholly unaccounted for by individual experiences and by the phenomena themselves. Apparently, only the psychic history of the race can offer adequate explanations. If the causes do not not appear in the phenomena, the cause must be in the soul itself. The soul in its long period of development must have passed through experiences, the present manifestations of which are but reverberations of a remote psychic past. To trace the genesis of these conceptions and feelings and to study the reaction of people, both in the past and in the present, toward this phase of nature is the object of this investigation.

Evidences of Man's Pelagic Ancestry.

There are several lines of argument which give such abundant proofs of man's pelagic ancestry that little doubt of it remains in the minds of scientists. Chief among these on the physical side are the proofs afforded by Embryology, Morphology, Paleontology and Pathology. Recent valuable additions have been made by a study of survival movements. By showing transitory characteristics in process, much may be gleaned indirectly from a study of these groups of animals which were once land animals, but which have returned to the sea.

Each of these classes of evidence, with the exception of that drawn from Paleontology, will be passed in review.

Embryological, ua. General. Man, like all other animals, begins life as a unicellular organism. The earliest stages of development which the human embryo passes through, so far as is known, resemble those of all other animals. The only difference between the development of the human embryo and the embryo of other animals is that the human embryo goes away beyond all other organisms in its unfoldment. But so close are the resemblances among the earliest embryonic stages that differences are unrecognizable. Some one has said, James, I think, that for some time no human being can determine whether a given embryo will turn out a frog or a philosopher. Romanes says[1] that when man's "animality becomes established, he exhibits the fundamental anatomical qualities which characterize such lowly animals as polyps and jelly-fish. And even when he is marked off as a Vertebrate, it cannot be said whether he is to be a fish, reptile, a bird or a beast. Later it becomes evident that he is to be a Mammal, but not till later still can it be said to which order of mammals he belongs."

Not only do the embryonic forms of all vertebrate animals, resemble each other in their general characteristics, but special organs or systems of the higher mammals, can be traced out in

[1] Darwin and after Darwin, I, 119.

the various stages of development. It is well known that resemblances of the mammalian embryos to lower vertebrates flash out as each new step is attained. As Prof. Drummond has put it we have "first the resemblance of the Fish, then of the Amphibian, then of the Reptile, lastly of the Mammal."[1]

b. Nervous System. Considering the development of the central nervous system we find that different stages of the human embryonic brain have close homologies in some of the great groups of lower animals. Man's brain passes through a series of stages of increasing complexity. These stages are only temporary in the human embryo, while they represent the maximum development of the group corresponding to each stage. Prof. H. DeVarigny says: "One may easily detect in the evolution of the human brain a stage corresponding to that of the brain of fishes; but while the fishes permanently retain this brain-structure, an advance occurs in man, and the brain acquires characters of the reptilian encephalon; later on it progresses again, and acquires bird characters, and finally it acquires those characters which are peculiar to mankind. Here again, ontogeny demonstrates phylogeny."[2]

c. Circulation and Respiration. Romanes sums up what Darwin and others had first pointed out concerning the development of the fœtal circulatory and respiratory organs by saying that, "at the time when the gill-slits and the gill-arches are developed in the embryonic young of air-breathing Vertebrates, the heart is constructed upon the fish-like type. That is to say, it is placed far forwards, and from having been a simple tube as in the worms, is now divided into two chambers, as in Fish. Later it becomes progressively pushed further back between the developing lungs, while it progressively acquires the three cavities distinctive of Amphibia, and finally the four cavities belonging only to the complete double circulation of Mammals. Moreover, it has now been satisfactorily shown that the lungs of air-breathing Vertebrata, which are thus destined to supersede the function of gills, are themselves the modified swim-bladders[3] or float which belong to Fish. Consequently all these progressive modifications in the important organs of circulation and respiration in the air-breathing Vertebrata, together make up as complete a history of their aquatic pedigree as it would be possible for the most exacting critic to require."[4]

Rudimentary Organs. In almost all animals and plants we find rudimentary or vestigial organs which serve no purpose in

[1] The Ascent of Man, p. 72.
[2] Prof. Henry DeVarigny: Experimental Evolution, p. 35.
[3] See Darwin: Descent of Man, pp. 160-61.
[4] Romanes' Darwin and after Darwin, I, 154.

the present life of the organism. Some of these appear only in the embryo, then become absorbed or pass away, leaving little or no trace of their presence. Everybody knows of the gills, tail, and swimming apparatus which frogs and toads possess during the tadpole stage, and which remain in adult life only as vestigial structures. There is a species of salamander (*salamander atra*) which lives high up among the mountains, brings forth its young full formed like the mammals, but whose tadpoles, or young, possess exquisitively feathered gill-slits. If the young chance to be removed from the body of the mother before the close of the normal period of gestation, the young salamanders will swim away like fish if placed in water. When born at full term they will drown as will the adult animal if placed in water. These organs, adapted to aquatic life, and which have "reference to ancestral adaptations, repeat a phase in the development of its progenitors."[1]

The life history of individuals cannot in every case, of course, present a full and complete recapitulation of its ancestors. To preserve all useless structures would be a waste of energy and material, and nature is never prodigal. The law of use and disuse are ever operative. As soon as structures lose their functions they tend gradually to disappear. If detrimental they are the sooner dropped off.[2] The vestigial or obsolescent structures which come regularly under our notice in any class of individuals are undoubtedly those which subserve some unknown purpose during embryonic life, or they are such as have only recently ceased to function. Those that appear occasionally, but are absent in the normal individuals, are probably the reverberations of long-since abandoned organs, but have become reawakened through stimulations that have called forth functions similar to those possessed by the organ in question, or they may belong to arrested development. To this class many pathological freaks and abnormalities may undoubtedly be referred. Romanes says that "the foreshortening of developmental history which takes place in the individual lifetime may be expected to take place, not only in the way of condensation, but also in the way of excision. May pages of ancestral history may be recapitulated in the paragraphs of embryonic development, while others may not be so much as mentioned."[3]

Vestigial Structures in Man. In the human body there are numerous obsolescent organs, which persevere in form only, and give unequivocal evidence of former ancestry. There are in all upwards of 130 that have been discovered. The vermi-

[1] G. H. Lewes, in Darwin's Origin of Species, p. 398.
[2] Romanes' Darwin and after Darwin, I, 103.
[3] Darwin and after Darwin, I, pp. 103-4.

form appendix is one of the best known. It is as fully developed during fœtal life as in adult. The muscles by means of which the external ear is moved is demonstrable only in exceptionally atavistic individuals. The *panicules carnosis*, or muscles by means of which animals move the skin, still exhibit vestiges of former function in man. Club-feet are said to be atavistic reminiscences of remote ancestors, meaning no more nor less than baboon feet.[1]

"Prominent among these vestigial structures are those which smack of the sea. If embryology is any guide to the past, nothing is more certain than that the ancient progenitors of Man once lived an aquatic life. At one time there was nothing else in the world but water-life; all the land animals are late inventions."[2] After emerging from the annelide and molluscan stages, what was to become man remained in the water until evolution had produced a fish-like stage; "after an amphibian interlude he finally left" the watery domain, but "many ancient and fish-like characters remained in his body to tell the tale."[3]

One typical vestigial structure which dates back to sea ancestry is the *plica semi-lunaris* or the remnants of the nictitating membrane of fishes. It is a semi-transparent curtain-like membrane formed on the inner side of the eye as a vertical fold of the conjunctivia,[4] which apparently is of great utility in sweeping across the eye to cleanse it. It is very common among birds, some fishes, reptiles, and amphibians,[5] and most vertebrates.[6] In man only a small fold or curtain draped across one side of the eye, and Romanes states that it is rudimentary only in animals above fishes.[7]

The most unequivocal rudimentary structures which give indication of water ancestry are the visceral clefts, or gill-clefts, in the neck-region. These were the first discovered vestigial structures to indicate the probable line of descent. These structures are first seen in the amphioxus, the connecting link between invertebrates and vertebrates. "In all water-inhabiting Vertebrates which breathe by means of gills the thin epithelial closing plates break through between the visceral arches, and indeed in the same sequence as that in which they arose. Currents of water, therefore, can now pass from the outside through the open clefts into the cavity of the fore gut, and

[1] Drummond: Ascent of Man, p. 96.
[2] Drummond: The Ascent of Man, p. 83.
[3] *Loc. cit.*, p. 85.
[4] Text-book of Embryology, Hertwig-Mark, p. 487.
[5] Darwin: Descent of Man, p. 17.
[6] Hertwig-Mark: A Text-book of Embryology, p. 487.
Darwin and after Darwin, I, 74.

be employed for respiration, since they flow over the surface of the mucous membrane. There is now developed in the mucous membrane, upon both sides of the visceral clefts, a *superficial*, *close*, network of blood-capillaries, the contents of which effect an exchange of gases with the passing water. Likewise in the case of the higher (amniotic) vertebrates,[1] both inner and outer visceral furrows, together with the visceral arches separating them, are formed; but here they are never developed into an actually functioning respiratory apparatus; they belong, consequently, in the category of rudimentary organs. Upon the mucous membrane arise no branchial leaflets; indeed the formation of open clefts is not always and everywhere achieved, since the thin epithelial closing membranes between the separate visceral arches are preserved at the bottom of the externally visible furrows."

The number of gill-clefts and visceral arches decreases in the ascending scale of vertebrate life. In some of the lower species, as the selachians, there are seven or eight, while birds, mammals and man, possess but four.[2] The number of external openings, also, is found to constantly decrease as we ascend the scale of life. In the higher mammals and man they would scarcely be known were it not for their detection in the embryonic stage. But they are discernible in the chick embryo on the third day of incubation, and they may be seen distinctly in the human embryo according to His when the embryo has attained a length of three or four millimeters. They begin to become obliterated by the fourth week of fœtal life.[3] But still says Drummond "so persistent are these characteristics [gill-slits] that children are known to have been born with them not only externally visible—which is a common occurrence—but open through and through, so that fluids taken in at the mouth could pass through and trickle out at the neck. . . . Dr. Sutton has recently (Evolution and Disease, p. 81) met with actual cases where this has occurred. . . . In the common cases of children born with these vestiges the old gill-slits are represented by small openings in the sides of the neck, and capable of admitting a thin probe. Sometimes, even, the place where they have been in childhood is marked throughout life by small round patches of white skin."[4] Dr. Hertwig also mentions the fact that fistulæ, which penetrate from without inward for variable distances, sometimes even opening into the pharyngeal cavity, are to be met with in human beings.

[1] Text-book of Embryology, Hertwig-Mark, pp. 286-7.
[2] *Ibid.*, p. 287.
[3] Hertwig-Mark: Text-book of Embryology, pp. 288-9.
[4] Drummond: Ascent of Man, p. 81.

These are explainable as being still open clefts of the cervical sinus.[1]

The ultimate metamorphosis of the embryonic gill-clefts is still a question of much interest. There is little doubt but that the thymus and probably the thyroid gland are derived from the visceral clefts.[2] The thymus is derived, according to Köl-liker, Born and Rabl, from the third visceral cleft. Some authorities, among them De Meuron and His, differ in minor points, principally as to the number of clefts involved,[3] but in the main they agree. The thymus is found in all animals, beginning with the fishes. Even in the fishes it is derived from epithelial tracts of the open gill-clefts still functionally active. Dohrn holds that the thyroid gland is the remnant of ancient gill-clefts of the vertebrates. Although this is disputed by Hertwig he still admits that "it appears to be an organ of very ancient origin, which shows relationship to the hypobrancial furrow of Amphioxus and the Tunicates."[4] It, at any rate, gives strong evidence of the close relationship, being developed "from an unpaired and a paired evagination of the pharyngeal epithelium,"[5] and in the region of the former visceral clefts, and by good authorities it is claimed to be developed from them. The so-called accessory thyroid gland is conceded by all to have thus arisen. The unpaired fundaments which contribute toward the thyroid are not wanting in a single class of vertebrates.[6] Dohrn makes several bolder hypotheses concerning the metamorphosed products of the embryonic clefts. He maintains (1) "that the mouth has arisen by the fusion of a pair of visceral clefts, (2) that the olfactory organs are to be referred to the metamorphosis of another pair of clefts, a view which is also shared by M. Marshall and others, (3) that a disappearance of gill-clefts in the region of the sockets of the eye is to be assumed, and that the eye-muscles are to be interpreted as remnants of gill-muscles."[7] Hertwig, however, dissents from some of these views. But, most embryologists are agreed that the middle and outer ear are derived from the upper portion of the first visceral cleft and its surroundings. In fishes there is no external auditory apparatus, and these organs, which in man develop into an ear, subserve another purpose. The Eustachian tube represents a partial closure of an original cleft; the tympanic membrane is devel-

[1] Hertwig-Mark: Text-book of Embryology, p. 290.
[2] *Ibid.*, p. 316.
[3] *Ibid.*, p. 316.
[4] Hertwig-Mark: Text-book of Embryology, p. 317.
[5] *Loc. cit.*
[6] *Loc. cit.*
[7] Hertwig-Mark: Text-book of Embryology, p. 288.

oped from the closing plate of the first visceral cleft and surrounding portions of the arches; and the external ear is derived from the ridge-like margins of the first and second visceral arches.[1]

"Ears are actually sometimes found bursting out in human beings half way down the neck in the exact position—namely, along the line of the anterior border of the sterno-mastoid muscle—which the gill-slits would occupy if they still persisted. In some families, where the tendency to retain these spacial structures is strong, one member sometimes illustrates the abnormality by possessing the clefts alone, another has the cervical ear, while a third has both the cleft and a neck ear—all these, of course, in addition to the ordinary neck ears.[2]"

Survival Movements. An exceedingly interesting and important study, and one which sheds much light upon the present problem, was carried out by Dr. Alfred A. Mumford, of England.[3] He noticed the peculiar paddling or swimming movements which a young babe, a few days old, made when it was placed face downwards with only hands and feet touching the floor, its head and abdomen being supported by a hand placed under each. Being struck with the great similarity of these movements to those made in propulsion through a watery medium he began a systematic study of infants' movements. Besides confirming and extending many of the recent observations concerning an anthropoid relationship he makes statements which are much more far-reaching.

He has noted that the position of the limbs at birth and during the first few weeks of infancy tend to assume the primitive developmental position, viz.: "folded across the chest, thumb towards the head, and with the palm towards the thorax; but more often the palm is away from the chest-wall, and is directed anteriorly by means of extreme pronation, the dorsum of the hand often lying on or near the shoulder, sometimes an inch or two outside. As the child wakes up the elbows begin to open out and the palm is pushed outwards in a way that would be useful in locomotion, especially in a fluid medium. In fact it is the movement of the paddle." These movements are described as slow rhythmical movements of flexion and extension, such as one sees among animals in an aquarium. They occur often in series of three at a time during a quarter of a minute, followed by alternating pauses. These are interpreted as vestigial movements of a former amphibian existence, which were of fundamental importance before forelimbs developed.

[1] *Ibid.*, pp. 505, 511.
[2] Drummond: Ascent of Man, p. 89.
[3] Brain, 1897.

This is supported by the shape of the hand, which is one of the most highly developed of bodily organs in function, but in some repects least modified of all the skeleton. "In shape and bones it is more like the primitive amphibian paddle than is the limb of any other mammal."

We also know that there are many reflex movements known as vibratory or oscillatory, which are especially common among children, though by no means confined to them. Among them are those of tapping, swaying, and others of a rhythmical nature.[1] Swaying from side to side is very noticeable in small school-children. They sway from side to side and forward and backward. Fish swim, in part, by similar movements, and in view of man's pelagic line of ascent, it is not improbable to suppose that swaying and possibly other reflex rhythmic and oscillatory movements may be recrudescences of former aquatic life. That they are atavisms, seems borne out by the fact that intellectual fatigue increases such automatisms.[2] That is, fatigue causes a temporary relaxation of the control exercised by the higher and more recently developed psychic centers and a reversion toward more primitive conditions. It is probable that all automatic movements, as well as expressive movements, are weakened repetitions of movements that were once of utility.[3]

Origin of Animal Life.

Not only have speculative philosophy and mythology claimed for everything a sea origin [see later sections in this paper] but science has actually demonstrated that the beginning of life was in the sea—near the bottom. This is as true of vertebrate as well as of invertebrate life.[4] Dr. Brooks writes: "We may feel sure even in the absence of sufficient evidence to trace their direct paths, that all the great groups of Metazoa ran back to minute pelagic ancestors."[5] Another authority writes that "for the present we may conclude that the proximate ancestor of the vertebrates was a free-swimming animal intermediate in organization between an ascidian tadpole and amphioxus." The same writer claims that the ultimate or primordial ancestor

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[1] See Dr. T. L. Bolton's article on Rhythm, *Am. Jour. of Psych.*, Vol. VI, p. 145.

[2] Lindley: Motor Phenomena of Mental Effort, *Am. Jour. of Psych.*, Vol. VII, p. 506.

[3] See Lindley, *loc. cit.*

[4] W. K. Brooks: The Genus Salpa Mem. Biol. Lab., Johns Hopkins Univ., p. 153.

[5] W. K. Brooks: The Genus Salpa, p. 159; see also p. 163.

of the vertebrates was a worm-like animal with an organization approximating the bilateral ancestors of the echinoderms.[1]

Science has also shown us that a great body of animals have been gradually crawling out of the sea. "From almost every country pond, or ditch, or swamp," says Miss Buckley, "a chorus of voices rises up in the spring-time of the year, calling to us to come and learn how Life has taught her children to pass from the water into the air; for it is then that the frogs lay their eggs, and every tadpole which grows up into a frog carries us through the wonderful history of animals beginning life as a fish in water with water-breathing gills, and ending it as a four-legged animal with air-breathing lungs."[2]

All the amphibians, or double-lived animals, are just emerging from the water. We find them in all stages of transition, some having only just begun to emerge, while in others the transition is so nearly complete that their former identity is scarcely discernible.[3]

But the young of all amphibians begin life in an aqueous medium, thus recapitulating, as all animals do, the life of the race. In embryonic, or tadpole life, all amphibians possess gills for extracting oxygen from the water, and organs for water locomotion. It is only when they reach an adult stage that they possess organs which equip them for terrestrial existence.

Animal Retrogressions to Aquatic Life.

But there have been many retrogressions in the process. Many animals after rising step by step above the fishes, and through the backboned animals until they reached a rank only a little below the primates, for some reason have gone back to the sea. The French song says "on revient tojours à ses premiers amours." Among those that have completely forsaken the land and assumed fish-like characters such as to almost elude detection are the whales, porpoises, and dolphins. Their fish-like forms and marine habits seem to indicate affinities with the fishes. But their internal structure, breathing, and mode of reproduction and suckling the young proclaim their mammalian kinship. They resemble quadrupeds in their internal structure, and in some of their appetites and affections. Like quadrupeds they have lungs, a midriff, a stomach, intestines, liver, spleen and bladder. The organs of generation and heart are quadrupedal in structure. "The rudimentary teeth of the whalebone-whales, which never come into use, are final

[1] Arthur Willey: Amphioxus and the Ancestry of the Vertebrates, p. 291.

[2] Arabella Buckley: Winners in Life's Race, p. 71.

[3] Dr. W. K. Brooks: The Genus Salpa, Memoirs fr. the Biol. Lab., Johns Hopkins Univ.

links in the chain of evidence." says Professor Oskar Schmidt,[1] "that the whalebone-whales are the last members of a transformed group which commenced with animals with four toes and numerous teeth, and which, by the gradual diminution of the dentition, have become whalebone-whales." The fins still retain the bones of the shoulder, forearm, wrist and fingers, though they are all enclosed in a sac and could render no service except in swimming. The head is also mammalian save in shape, which has become modified and fish-shaped for easier propulsion in the water. The mammalian skull with all the bones in their proper anatomical relations to one another are still preserved.[2] Prof. Schmidt says in regard to the dolphin that the "hind limbs, like those of the Sirenians, have disappeared externally without leaving a trace of their former existence; the rudimentary pelvic bones that are concealed in the flesh—sometimes with the last remnant of the thigh bone, very rarely with the shank—bear witness, however, to their having possessed ancestors with four legs."[3]

There are several species of animals that exhibit the transformation still in process. Such, for example, is the polar bear, which is about half aquatic. This animal really gave us the first hint that some mammals may revert to a water stage of existence.[4] His body, much longer and more flexible than that of common bears, enables him to adapt himself to water locomotion. His feet have become decidedly broad, his head pointed, and his ears small, thus enabling him to propel himself through his aqueous habitat with ease. Other bears hug their prey, while this one uses teeth and claws entirely. The soles of his feet have become provided with long hair, which provide against slipping on the ice. They have largely lost their hibernating habits, and fish and hunt throughout the winter.[5] The seals show by the shape of their skull, dentition, and mode of life that they are carnivorous animals that have adapted themselves to a life in water. Their limbs are metamorphosed into fin-like rudders.

Instead of a perfect fish-like tail he has two legs flattened together, with nails on the toes. These are obvious superfluities, but remain as an inheritance from ancestors to which they were of use, but they have now become modified by the present fish-like habits of the animal. Sea otters, the nearest relatives of the seal, have also become pure fish-eating animals. The

[1] The Mammalia, p. 248; see, also, J. G. Romanes, Darwin and after Darwin, I, 50.
[2] Romanes, Darwin and after Darwin, II, 51.
[3] The Mammalian, p. 250.
[4] Arabella Buckley: Winners in Life's Race, p. 295.
[5] *Op. cit.*, pp. 295-8.

Sirenia,[1] which comprise the dugongs and manatees resemble the true *Cetacea* (whales, dolphins and porpoises) in their adaptation to an aquatic mode of life and the absence of pelvic limbs, but are probably more nearly allied to the *Ungulates*. These now aquatic animals are plainly retrogressions from the regular land type. They are somewhat fish-like in form, the posterior portion of the body being developed into a caudal fin. Hind limbs are lacking, and the forelimbs have been modified into swimming-paddles or flippers. The ear has lost the external concha. A few bristles still cover the thick skin and tell of former life. They are vegetable feeders (called herbiverous Cetaceans by Cuvier). There are two mammary glands, pectoral in position. The pelvis is rudimentary, some teeth are rudimentary, and some species possessed a rudimentary femur. They date back to the Eocene Tertiary period, while the cetacea probably extend to the secondary period.

Among reptiles which represent these atavistic traits there are the oceanic turtles, and the sea snakes; among the birds, the penguin, whose wings are scarcely different from the true fins of fishes. Then, again, from the mammals might be named the web-footed, duck-billed platypus, the web-footed opossum of South America, the beaver, and the walruses and sea lions.[2]

In all these classes of animals that have returned to aquatic life, we notice that in the process of evolution the most marked changes have taken place in the least typical structures,—those which are least strongly inherited, such as skin, claws and teeth. The aqueous medium necessitates a change of covering. Instead of fur, which we know (from the few straggling bristles) they once possessed, a smooth surface, offering little resistance is advantageous. To still maintain adequate bodily heat a covering of fat under the skin is acquired. The whale has evolved a layer of blubber in some cases one and one-half feet thick. The changed medium modifies the locomotor organs —does away with the necessity of legs and necessitates, instead, swimming apparatus. The anterior end becomes more pointed to reduce resistance to the minimum. It should be noted, however, that the head retains essentially all the functions it possessed, being modified only in form. In all cases the eyes become much reduced in size. In whales they suffer so much reduction that they can scarcely be found. The same change is taking place in the eyes of seals, polar bears, walruses, and other animals of this type. Dentition has suffered so much change that whales possess only rudimentary teeth that never cut the gum. In the living species of sirenians the jaws carry

[1] Nicholson: Manual of Zoölogy, Chap LXVI.
[2] Arabella Buckley: Winners in Life's Race, p. 299.

more or fewer molar teeth, which have flattened crowns, while the front of the upper and lower jaws is furnished with rough horny pads or plates. In the genus *Rhytina*, now extinct, there were no true teeth, but the places of these were taken by plates of horn. Incisors are also present, but they do not cut the gum, except in the case of male dugongs. Nostrils become situated on the upper surface. The anterior organs of locomotion suffer much less change in form than the posterior, though they assume entirely new functions. In general the bones of the shoulder, forearm, wrist and fingers, are retained, although they become encased in a fin-shaped sac, so as to become better fitted for swimming.

The entire posterior end, as well as the hind legs, undergo a most radical metamorphosis. The hind legs are no longer needed for walking, and soon atrophy entirely or become merely rudimentary. In the whales, porpoises, and other animals, which have completely forsaken the land, the hind legs have completely disappeared externally, and only the rudimentary bones give evidence of the species ever having possessed legs. Synchronously with the atrophy of the hind legs there occurs a loss of the sacrum and pelvis. In the sirenians there is no true sacrum, and the pelvis is only rudimentary. The lungs instead of degenerating become enormously enlarged, and enable their possessors to remain under water great lengths of time. The whalebone whale can remain under water for an hour at a time without reinflating its lungs.

The reversion to an aquatic medium seems to be promotive of great increase in size. This is probably due to several causes. First, the expenditure of energy in locomotion is greatly reduced; second, the ease of securing food is greatly increased, the whale having only to open his mouth as he swims to entrap myriads of minute marine animals; third, it is probable that the loss of a pelvis is advantageous, as much larger young may be born without injury than when the pelvis is present. Among land vertebrates we know that many of the largest and most promising of the various species succumb to the dangers, attending birth, arising from a narrow pelvis.

Psychic Reverberations. We cannot hope to unravel all of man's mental history with any such demonstrable certainty as we can reconstruct his past physical history. Mental states are the most fleeting and least preservable entities, and although we must logically conclude that the record of no psychosis is ever effaced, yet the majority become so intricately blended and interwoven and overgrown with other more recent acquisitions that no psychology will ever be able to reconstruct the entire race history. Only the most oft-repeated and most far-reaching psychic acts leave traceable evidences. But patient and careful

work will enable us to understand much of man's psychic past through survivals and rudimentary organs, just as we have been aided in tracing psychical development. But just as all psychic organs are less demonstrable than physical, so rudimentary psychic phenomena are less capable of proof than vestigial physical structures. There is, however, unquestioned evidence of numerouus rudimentary psychic traits and many others which, though not capable of rigorous demonstration, give strong evidence of their origin. Traces of peculiar manifestations of the souls of our remote ancestors are to be met with in "the present reactions of childish and adolescent souls, or of specially sensitized geniuses or neurotics." There are also times in the life of the normal individual when the control maintained by the higher and more recently acquired centers is apparently suspended, and the lower and older centers then given full sway seem to step in, and the resulting psychical phenomena present traces of long past activities. Such conditions are evidenced in sleep and dreams. Idiots present childish and even animal mentality, showing that the higher centers have failed to function. Instead of evincing rudimentary psychic phenomena in the true sense, they are cases of arrested development. Their lives are made up of those activities that are common to animals and to humanity in its infancy. Again, there are certain modes of thought that crop out in the form of omens, superstitions, sayings, proverbs and signs, to which we ordinarily attach no importance, but often hear and repeat. All these have a meaning to the psychologist. They are to him vestigial or rudimentary organs, and suggest use in a remote past. "Few things," says Black,[1] "are more suggestive of the strange halts and pauses which mentally a people makes than to note how superstition springs up in the very midst of modern education." They are to the psychologist what gill-slits are in pathological cases of arrested development. Children are very prone to be superstitious, which is also true of savages.

The range of atavistic psychoses is practically unlimited. Admitting memory to be a biological fact we assume that every impression leaves an ineffaceable trace, by which we mean that vestiges or predispositions or habit-worn paths of association are formed which will function again when properly stimulated. Conservation of impressions is a state of the cerebral organism. The effect once produced by an impression upon the brain, whether in perception or in a higher intellectual act, is fixed and there retained. The retention of any act in memory, according to James,[2] is an unconscious state, purely physical, a

[1] Folk Lore in Medicine, p. 218.
[2] Prin. of Psych., I, 655.

morphological feature. According to Ribot we may assume that persistence of memories, "if not absolute, is the general rule, and that it includes an immense majority of cases."[1] This, of course, applies only to the persistence of memories during the individual's life. but, as Dr. Hall has pointed out,[2] "we may fancy, if we like, that on some such theory as, *e. g.*, Mach's of hereditary, or a form of memory by a direct continuity of molecular vibration in cells or their elements (Weissmann's biophor's, Wisner's plasomes, de Vrie's pangens, Nägeli's micellæ, etc.), or in any less material way," that these traces or vestiges are continued, and may, even though apparently forever effaced, reappear in future generations in children or pathological cases. Multitudes of impressions, even in the individual's existence, may never be recalled, but they might be if the proper stimulus occurred, or if more recent memory modifications were removed, and the older memories, as it were, set free. Evidence in support of such a theory is furnished by pathological cases. Events long since apparently forgotten often reappear in disease. This is accounted for by the destruction of the more recent and higher centers. According to Ribot the law of regression is that a progressive dissolution of the memory proceeds from the least organized to the best organized, from the new to the old. In physiological terms "degeneration first affects what has been most recently formed." In psychological terms "the complex disappears before the simple, because it has not been repeated as often in experience." Hence, may not such cases give us glimpses of the remote psychic past, even of the paleo-psychic age?

In sleep we have similar conditions. The higher centers having relaxed their control, there flash into consciousness great accumulations of old experiences that we did not know we possessed. Those which are the most retrospective and atavistic take us back through the remote periods of the development of the race consciousness. In the psychic life of sleep our consciousness may extend backward to embrace all that our ancestors have lived and felt and bequeathed to us as an indestructible organic patrimony." Some of the somnolescent phenomena certainly point to aquatic existence. Consider the sensations of flying, hovering, swimming, floating, and jumping indefinitely, as with seven-leagued boots. Nearly everybody can bear testimony to these sensations. Sometimes it is a sort of skating or gliding across countless miles of country or of ocean, sometimes it is a giant-like striding from mountain-top to mountain-top, sometimes the perfect eagle-swoop through the blue of

[1] Diseases of Memory, p. 185.
[2] *Amer. Jour. of Psych.*, Vol. VIII, 173.

space, effortless and superb. Many testify to taking hundred-mile steps, for jumping contests imaginarily performed in sleep are of such a character as would excite the admiration of the fabled gods. These states undoubtedly arise from disturbed circulation and respiration, for both of these acts are much deranged in an actual fall through space. And, as Dr. Hall suggests,[1] "as lungs have taken the place of swim-bladders, the unique respiratory action of hovering, as in nightmare, with all the anakatæsthesic phenomena, and perhaps the eluæsthesic sensations of a falling, which are quite distinct from the former, although not without common elements, suggest the possibility that here traces of function have survived structure. . . . Our ancestors . . . . floated and swam far longer than they have had legs . . . . and why may there not be vestigial traces of this, as there are of gill-slits under our necks? . . . . Although it cannot be demonstrated like rudimentary organs, I feel strongly that we have before us here some of the oldest elements of psychic life, some faint reminiscent atavistic echo from the primeval sea."

The study of methods of suicide offers some very interesting data to the psychologist. The characteristic mode of procedure adopted by different nations throws light upon racial psychology, while the differences in the methods employed by men and women in accomplishing this terrible deed throw considerable light upon sexual psychology. All statistics show very strikingly that many more women than men commit suicide by drowning. And women choose this method more often than any other. This represents a fundamental psychic difference between men and women. The woman represents the oldest and most primitive features of the race; the man that which is more recent and artificial. This is also true from a biological standpoint. Woman's body seems to be somewhat more primitive and conservative than man's. This is witnessed in her greater nearness to the quadrupedal position, in the length of body, smaller size, etc. Woman represents that which is more conservative in the race. In woman there are seldom abnormalities of bodily structure, and variations are much less pronounced than in man. "From an organic standpoint, therefore, men represent the more variable and the more progressive element, women the more stable and conservative element in evolution. . . . . In various parts of the world anthropologists have found reason to suppose that the primitive racial elements in a population are more distinctly preserved by the women than the men."[2] Of their mental characteristics the

[1] *Am. Jour. Psych.*, VIII, Jan., 1897, p. 158.
[2] Havelock Ellis: Man and Woman, p. 367.

same authority writes that "on the psychic side women are more inclined than men to preserve ancient customs and ancient methods of thought."[1]

If it be true that women are phylogenetically nearer primitive human beings than man, it is not strange that in methods of suicide they should choose the primitive and more natural means oftener than man. It would be strange were the statistics otherwise. The theory has often been advanced that the methods of suicide selected have a close connection with the occupation of the persons during life. To illustrate, a soldier would choose firearms, a druggist poison, etc. The theory is probably in a large measure true, but it in no way vitiates the theory that the most primitive and most conservative choose the most primitive methods. Statistics show that men prefer active methods, while women prefer passive methods. Women give themselves to the power of natural forces or elements, as, for example, to gravity when they throw themselves from heights or into the water and then wait for the end, while men make themselves the active agent in manipulating some artificial contrivance, a pistol, a rope, a bomb-shell, or the like. Many more women than men suicide by taking poison, which Dr. Chamberlain has pointed out to be an atavistic tendency. Women were the earliest agriculturists, and earliest learned the use of vegetables as articles of diet, as curatives, and as agents of destruction. From these early employments of women she learned to be a vegetarian, a trait she still possesses, and she earliest learned the use of poisonous herbs. The result of this last still reverberates through her organism, and to-day when woman determines to exterminate a fellow-being or an animal, poison is about the only means sought, while a man would employ a gun, a knife, or an explosive. In attempting her own life, though poison is often resorted to, a more primitive method is more often chosen. "Throughout Europe the law roughly stated is that men hang themselves; . . . . with modifications this rule probably holds good all over the world."[2] In India, where the people represent a more primitive stage, according to Cheevers,[3] six out of every seven women who commit suicide seek drowning as a means. The proportion of men who drown themselves is also greater there than in other countries. In the Celto-Latin nations, France, Italy, Belgium, Sweden, Switzerland, drowning among women shows the highest percentages of any countries. For some reason or other among the Slavic nations

[1] Havelock Ellis: Man and Woman, p. 368.
[2] Havelock Ellis: Man and Woman, pp. 334-5.
[3] Quoted by Ellis: Man and Woman, p. 335.

drowning is at a minimum.[1] Strange to say, the atavistic tendencies are becoming stronger, according to Havelock Ellis, who says that "hanging has become much rarer in both men and women, while drowning and poisoning have become commoner in both. That is to say, that women have become more womanly than ever in their preference for the passive methods of suicide."[2]

May not many cases of suicide by drowning and the otherwise unexplainable "drawing power" of water so frequently experienced, be explained by supposing a temporary or permanent suspension of control by the higher psychic centers allowing a recrudescence of the old love for aquatic conditions. The fear which has been later formed, and which normally is in equilibrium with the love of water becomes overbalanced, and hence the desire to jump in. The philosopher, August Comte, during a fit of temporary insanity insisted on plunging into the lake with neither thought nor intention of drowning. The returns to my syllabus furnish many cases which attest to the feeling that water exerts a peculiar attraction for many individuals.

The sight of waves, billows, or in fact any water, makes some desire to ride upon it; many want to plunge in, and others are tempted to follow the streams. Some cannot go bathing without feeling an imperative impulse to go down forever; to leave care and pain; to end life; so they won't know any more, etc. One says she always thinks like Longfellow: "Oh that the river might bear me away on its bosom to the ocean wild and wide." During trouble many long to escape from it all by plunging in and being engulfed by the rushing waters.

Water in Primitive Conceptions of Life.

We shall see that in all early Greek philosophy water was an integral part in all conceptions of life. Some assumed it to be the origin of all things; others said that water was *one* of the primitive elements, and that all plants and animals either came from or were made of water. The same ideas were current in mythology, and are prevalent among some people to this day. Peoples like the Egyptians, and those in southern and western Asia, who lived in countries subject to periodic drouths, were not long in concluding that water was necessary to the germination and growth of plants. During dry weather vegetation withered; during periods of abundant rain it waxed vigorously. They very naturally ascribed to water the powers of a supernatural being. It became to them not a condition of life, but the origin of life itself.

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[1] Havelock Ellis: Man and Woman, p. 336.
[2] *Ibid.*

The potency and life-giving properties ascribed to water are shown in Egyptian writings where "it appears in such phrases as 'spirit of water,' the source. It is a conspicuous hieroglyphic in the verb 'to live;' also in 'living' and light."[1]

Among the Ojibwas it is supposed to have magic power over life and death. It is not strange that among the Egyptians, where the annual overflow of the Nile meant life itself, that water deities should assume so important a place. The river was presided over by the god Nilus. The most important Egyptian festival was the one held at the annual summer solstice in honor of the Nile.[2] At this time an invocation was made to the river deity for the inundation. An image of the god Nilus was encircled by a serpent, and from beneath the rocks of a cataract a hydra poured forth sacred water.

The idea of resurrection undoubtedly grew, in part, out of the common observation of plant life. Vegetation flourishes during a season, appears to lose all vitality during a succeeding season, but when spring returns it becomes once more rejuvenated. Again, plants flourish, produce seed, and wither away. The seed in turn, under proper influences, germinates and produces new plants. It was but a step to arrive at the belief that man also, after death, must live again. We have seen that the primitive mind regarded water as the rejuvenating principles of all plant life, and hence it will not appear strange that the notion should be extended to include the resurrection of man.[3] Among the ancient Egyptians the ceremonials of the dead all indicated an expected resuscitation of life, and water was always made the emblem of rejuvenescence, whether in connection with human dead or with plants. In the Book of the Dead, water was the symbol of revivification. They "believed in the resurrection of the dead through the same fertilizing power as that which regenerates the plant world."[4] Primitive peoples generally, we may say, have taken cognizance of water in the ceremonials over the dead. And the return of life is always spoken of in connection with it. In Egypt funeral processions always had to pass by the sacred lake, which was near every city, and consecrated to the dead. In their funeral rituals the departed soul is represented as a ship with four rudders pointing to the four cardinal points. The ancient Hindoos buried the dead beneath the bed of a stream whose current was temporarily turned aside. The Greenlanders say that when one sleeps by the river he can hear the singing of the dead. Some Australians say that the soul, which they call the "little body," goes into the sea at death.

[1] Ellen Emerson: Rain Ceremonials, American Anth., Jul., 1894.
[2] Frazer: The Golden Bough, I, pp. 15-17.
[3] *Op. cit.*, I, p. 93.
[4] Ellen Emerson: Rain Ceremonials, Am. Anth., Jul., 1894.

Various symbolisms were early adopted to signify water. In Egypt it was Ptah, the frog, the "Father of Fathers," who was a symbol of the vital principle in water, its principle of reorganization. The hieroglyphic representing Ptah was regularly placed in the tombs of the dead. Its office was at some future time, to reunite the scattered parts of the body. Among some Indian and various other tribes the serpent symbolizes the watery element, air or breath, which are necessary to life.[1] We have also noted in various rain ceremonials the position of frogs, toads and serpents. In Babylonia, Thammuz was supposed to be resurrected by the water of life which the goddess Aphrodite brought up from Hades. That water was regarded by the Indic Aryans as the source of all things is shown in the Rig Vedas which tell us that "waters contained a germ from which everything sprang forth." The Peruvians worshipped Mama-cocha, the mother sea, from which had come everything, even giants, and the Indians themselves. In Peru water was everywhere worshipped, and it was believed that the Incas originated in lake Titicaca, while other fabled tribes came from fountains and streams.[2]

The rain ceremonials performed by various peoples for the purpose of securing rain are of exceeding interest. Although the details vary considerably the ceremonials may all be classed under a few heads. Sometimes rain is sought to be produced by *sympathetic magic*,[3] that is, it is believed that by imitating some of the attendant phenomena they can influence the course of nature. For example, by beating on a kettle to imitate thunder, knocking two fire-brands together and causing sparks to fly to imitate lightning, and sprinkling water from a vessel by a bunch of twigs, as is done in some parts of Russia, the people believe that rain will be produced.[4] Many tribes take a mouthful of water, spirt a part of it into the air, thus making a fine mist, to simulate rain. This is common among the Omaha Indians and certain other tribes.[5] In Germany and France it is said to be customary to throw water upon the last sheaf cut at harvest. The same custom prevailed in England and Scotland until recently. In Transylvania among the Roumanians a girl wears a crown made of the last cut grain. When she comes home all hasten out to meet her, and throw water upon her until

[1] See Ellen Emerson: Rain Ceremonials, Am. Anth., July, 1894, for account of Egyptian and N. Am. Indian rain ceremonials; also Weather-making, Ancient and Mod., Mark W. Harrington, Smithsonian Rep., 1894.

[2] Dr. Chamberlain: The Child and Childhood in Folk Lore, pp. 38-9.

[3] Ellen Emerson, *op. cit.*

[4] Frazer: Golden Bough, I, p. 13.

[5] *Op. cit.*, p. 15.

she is completely drenched. This is done to insure rain for next year's crop.[1] Sympathetic magic among the savages, Mr. Frazer regards as exactly analogous to the modern conception of physical causation. A man-god in this view, is only an individual who is believed to possess the power of influencing nature to a high degree.[2]

Another way of trying to secure rain is by *coercion* of the *rain-god.* In some parts of China a huge wooden or paper dragon, representing the rain-god is carried about in a procession. If no rain follows they curse it and demolish it. The Senegambians throw down their fetishes, drag them about the fields and curse till rain falls.[3] Still another way is to *disturb the gods* in some way. Troubling the sacred springs by throwing impurities into them is believed by the Dards to bring rain. Other springs need only to be looked at and the whole province secures rain.[4] Sometimes an appeal is made to the *pity of the gods.* The Zulus kill a "heaven bird," throw it into a pool, "then the heavens melt with tenderness for the death of the bird; it wails for it by raining, wailing a funeral wail."[5]

Various other methods are resorted to in different parts of the world. The Samoan rainmakers wet some sacred stones when they wish rain, and put them into the fire when they desire dry weather.[6] In China Ke-mung, who is man-shaped and dragon-headed, haunts the Chang River and causes rainstorms.[7] In the same country water-spouts are said to be caused by dragons fighting in the air.[8] The *Dodola* or girl dressed in clothes made of grass, herbs and flowers, who goes about from house to house and sings while the housewife pours water over her, is a common rain-charm in southeastern Europe. It is found among the Servians, Greeks, Bulgarians and Roumanians.[1] Beating, pinching, and beheading frogs is quite a common rain-charm among the Orinoco Indians, and killing the frog is an old German rain-charm.[2]

Water in Philosophical Speculation. *

Not only among savage tribes has water played an important rôle in their mythological explanation of the world, but even in philosophic thought water has been the subject of much speculation. It assumed an important place in early Greek cosmo-

[1] *Op. cit.*, I, p. 286.
[2] *Op. cit.*, I, p. 12.
[3] *Op. cit.*, I, p. 18.
[4] *Op. cit.*, I, p. 19.
[5] *Loc. cit.*
[6] Tylor: Early History of Mankind, p. 133.
[7] Denny's Folk Lore of China, p. 98.
[8] Conway: Demonology and Devil-lore, II, 107.

logical theories. The Greek philosophers were not the first to form theories of the origin of the universe; such theories, more or less mythlogical of course, were extant among all tribes. But the Greeks were the first to seriously attempt to understand nature. Burnet says "the real advance made by the scientific men of Miletos was that they left off telling tales."[1] They had noticed the constantly changing aspects of nature, the eternal flux as Heracleitus later puts it, and their minds began to grope and yearn for some unitary principle to which the eternal succession of changing objects could be reduced. They did not, it is true, abandon the speculation concerning origins, but their scientific contribution was the search for a unitary principle in what was present. "They gave up the hopeless task of describing what was when as yet there was nothing, and asked instead what all things really are now?"[2] Parmenides asserts that "nothing comes into being out of nothing, and nothing passes away into nothing." But they observed the continual coming into being and corresponding passing away of particular things. From this it was natural to pass to the assumption of a substratum which was the ultimate and only reality. As "nothing comes from nothing, nothing can pass away into nothing, there must then be something which always is, something fundamental, which persists throughout all change, and ceases to exist in one form only that it may reappear in another."[3]

It is interesting to note the cause of the change in cosmological doctrine among the early Greeks. Much of the change was undoubtedly due to the increased knowledge of the sea, which had hitherto represented to them the boundless, at least so far as mortal knowledge was concerned. What was unattainable, beyond reach, unexplainable by natural means, was placed beyond the sea. Their world was bounded by the sea, it rested upon the sea, the mythical heroes dwelt in or beyond the sea. But with the increase of maritime knowledge in the 5th and 6th centuries B. C., old conceptions had to be abandoned for something new. At the time the Odyssey was composed, Odysseus met with Circe, the Cyclops, and the Sirens, not in the near and familiar Ægean, but in the "West," which meant to them beyond the known sea.[4] But with the increase of geographical knowledge it was discovered that the monsters and beings purported to be the inhabitants of countries beyond the sea, were no longer

[1] J. Burnet: Early Greek Philosophy, p. 8.
[2] Burnet: *op. cit.*, p. 8.
[3] Burnet: *op. cit.*, p. 10.
[4] Geo. Grote: Hist. of Greece, I, 342-3.

there, and a doubt of their ever having been there arose.[1] About this time they changed the name of the "Inhospitable Sea" to the "Hospitable Sea."[2] They had determined the location of the "far country," and Jason was made to bring the Golden Fleece from a definite place Kolchis.[3] Burnet says, "above all, the Phokaians had explored the Mediterranean as far as the Pillars of Herakles, and the discovery that the 'endless paths' of the sea they knew had definite boundaries must, as Grote has said, have moved men's minds in much the same way as did the discovery of America in later days."[4]

To return to their cosmological theories, we can readily understand how in their search for the eternal, original, unitary substance through whose changes and motions all else arose, that they should turn to those things which were either ever present, most abundant, or presented the greatest possibility of change, but which at the same time appeared to possess some simple form beyond which further change was impossible. This the various philosophers thought they discovered in the elements,—earth, air, fire and water. Some chose one, some another, and still others believed that all were necessary for a satisfactory explanation.

Thales, the founder of the Milesian school, and probably the first of the cosmologists in seeking a primary, fundamental matter, something which would answer the question: Of what is the world made? proposed the answer: *water*. All special existences were but modes of this primary substance. He saw about him "constant transformations—birth and death, change of shape, of size, and of mode of existence—he could not regard any one of these variable states as Existence itself. . . . . He looked around him, and the result of his meditation was the conviction that Moisture was the Beginning. He was impressed with this idea by examining the constitution of the earth. There, also, he found moisture everywhere. All things he found nourished by moisture; warmth itself he declared to proceed from moisture; the seeds of all things are moist. Water when condensed becomes earth."[5] Further, as Burnet points out the process that evaporation was continually going on around them, the phenomenon which rural people call the "sun drawing water" was then as observable as at the present day, and the conclusion was probably similar. The Greeks went a little further than the rustic of to-day, and asserted that this water passing into the sky by evaporation went to feed the heavenly

[1] *Op. cit.*, p. 334.
[2] J. Burnet: Early Greek Philosophy, p. 14.
[3] *Ibid.*
[4] *Ibid.*
[5] Geo. H. Lewes: Hist. of Phil. from Thales to Comte, Vol. I, p. 7.

fires. After coming down in rain they thought it changed into earth. Then from the phenomena of mists and subterranean springs they believed that earth once more was converted into water. They did not connect springs with rain, and the waters underneath the earth were regarded as an independent source of moisture.[1]

Anaximander (610 B. C.) did not agree, saying that the elements "are in opposition to one another,—air is cold, water moist, and fire hot,—and therefore if any one of them were infinite, the rest would cease to be by this time."[2] He regarded the world, according to Burnet, as a boundless mass or body out of which "our world once emerged by the 'separating out' of the opposites, moist and dry, warm and cold."[3] But, although Anaximander made a great advance over the ideas of Thales, no longer considering the earth as a disc resting upon the waters, the potency of moisture or of water was still clearly visible in his system. His ideas of the origin of living creatures, as chronicled by Theophrastus,[4] are as follows: "Living creatures arose from the moist element as it was evaporated by the sun. Man was like another animal, namely, a fish, in the beginning." Hipp. *Ref.*, i, 6 (R. P., 16 a).

"The first living creatures were produced in the moist element, and were covered with prickly integuments. As time went on they came out upon the drier part, and, the integument soon breaking off, they changed their manner of life." Aet.=*Plac.*, v, 19. 1 (R. P., ib.).

"The sea is what is left of the original moisture. The fire has dried up most of it and turned the rest salt by scorching it." Aet.=*Plac.*, iii, 16. 1 (R. P., 14 c).

Anaximenes (588 B. C.) appears at first sight to have taken a different element from any of his predecessors as the one underlying substances from which all things come. According to the account given by Theophrastus "from it . . (air) . . the things that are, and have been, and shall be, the gods and things divine, took their rise, while other things came from its offspring." Hipp. Ref., i, 7 (R. P., 21).[5] Burnet explains, however, that "the 'air' of which Anaximenes spoke was not at all what we call by that name. The word ἀήρ is still used in its old Homeric sense of vapor or mist. The discovery that what we call air was corporeal, and not identical with empty space, was first made by Empedokles. In all the earlier

[1] J. Burnet: Early Greek Philosophy, p. 45.
[2] Quoted by J. Burnet from Aristotle's Phys., Early Greek Philosophy, p. 51.
[3] J. Burnet: Early Greek Philosophy, p. 61.
[4] These references quoted by J. Burnet, Early Greek Phil., pp. 73-94.
[5] *Loc. cit.*, p. 77.

cosmologists ἀήρ means water in a vaporous state more or less condensed."[1]

Below are quoted several passages of the *opinions* of Theophrastus which give the key to the cosmology of Anaximenes. "When it is dilated so as to become rarer, it becomes fire; while winds on the other hand are condensed air. Cloud is formed from Air by 'felting,' and this, still further condensed, becomes water. Water, condensed still more, turns to earth; and when condensed as much as it can be, to stones." Hipp. *Ref.*, Aet. (R. P., 21).[2]

Thus we see Anaximenes practically returning the view of Thales, making everything come from the ἀήρ or moisture, and even holding that the disc-shaped earth floated upon it.

Xenophanes, though not making himself clear concerning his cosmological theories, seems to incline largely to the Anaximandrian view. Though he denied the conception of a primary substance[3] he says:

"All things are earth and water that come into being and grow."[4] R. P., 86.

"For we all arise from earth and water." R. P., 86.[5]

Heracleitus (504 B. C.), not satisfied with former cosmology sought a new principle, out of which the diversified world might be made, which would change into everything else, and which would be produced by everything changing back into it. This he thought he found in "fire—real fire, of course, 'that burns and crackles,' as Teichmüller put it."[6] Many interpreters, however, regard this fire as only symbolic, and claim that the word was used with the same significance as Anaximenes had used air, that is meaning mist or moisture.[7] Be this as it may, Heracleitus regarded fire, water and earth, as the fundamental forms which water assumed in its transformation[8] in his celebrated "flux" theory gives to water great prominence.

Theophrastus records that "he called change the upward and the downward path, and held that the world goes on according to this. When fire is condensed it becomes moist, and when collected together it turns to water; water being congealed turns to earth (the conjecture of Theophrastus); and this he calls the downward path. And, again, the earth is in turn

[1] *Loc. cit.*, p. 78.
[2] *Loc. cit.*, p. 81.
[3] *Loc. cit.*, p. 124.
[4] *Loc. cit.*, p. 115.
[5] *Ibid.*
[6] *Op. cit.*, p. 148.
[7] *Op. cit.*, p. 148 for discussion of interpretation; also Zeller, Pre-Socratic Philosophy, II, 51 ff.
[8] Zeller: Pre-Socratic Philosophy, II, 51.

liquified, and from it water arises, and from that everything else; for he refers almost everything to the evaporation from the sea. This is the path upwards."[1] R. P., 29.

From Hyppolytas, who probably represents Heracleitus accurately, in Mr. Bywater's edition we learn that Heracleitus believed that "the transformations of Fire are, first of all sea (and half of the sea is earth, half fiery storm-cloud"). R. P., 28 b.[2]

"The earth is liquified, and the sea is measured by the same tale as before it became earth."[3] R. P., 31.

Heracleitus believed that there was a constant flux between fire and water. One prevailed for a time, then the other, but that neither gained the permanent ascendancy. The balance was maintained by the "measures," as he called them. Measures of "ever-living fire" were ever going out, while compensatory "measures" were being kindled.[3] He writes, "so long as things as they are, fire and water will always be too, and neither will ever fail." Ps. Hipp., *De Diaeta*, i, 3.[4]

By the oscillation between fire and water Heracleitus explained the change of seasons, and day and night. Like the heavenly bodies man, also, oscillates between fire and water.[5]

Hippolytas interprets Heracleitus as saying:

"The dry soul is the wisest and best."[6] R. P., 34.

"For it is death to souls to become water, and death to water to become earth. But water comes from earth; and from water soul."[4] R. P., 30 B.

"It is pleasure to souls to become moist."[4] R. P., 38 b.

"A man, when he gets drunk, is led by a beardless lad, knowing not where he steps, having his soul moist."[4] R. P., 34.

Empedocles held that there were four fundamental and primary elements, fire, earth, air and water.[7] According to him plants and animals are composed of fire and water in definite proportions. Likewise man sprang from the earth, at first composed of shapeless lumps of earth and water, thrown up by subterranean fire, which gradually shaped themselves into human members under the influence of Love.[8]

Anaxageras followed in a large measure the cosmological doctrines of Anaximenes. He taught that plants and animals all originated in germs which came down in rain-water.[9]

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[1] Burnet: *op. cit.*, p. 151.
[2] Burnet: *op. cit.*, p. 135.
[3] Fragment 20. Quoted by Burnet, *op. cit.*, p. 135.
[4] Burnet: *op. cit.*, p. 135.
[5] Burnet: *op. cit.*, p. 162.
[6] Burnet: *op. cit.*, p. 138.
[7] Zeller: Pre-Socratic Philosophy, II, p. 125, *et seq.*
[8] Zeller: *op. cit.*, pp. 159-161.
[9] Zeller: *op. cit.*, p. 365.

These cosmological theories, trivial as they may now appear, were of the utmost significance. Who would for a moment question the great importance of the atomic doctrine of elements? Probably no other hypothesis in ancient or modern times has been so potent in determining our knowledge of the physical universe. Now, in all these crude attempts to answer the question proposed by Thales, we can distinctly foresee the struggles toward, if indeed not the germs of, a future atomic theory. They were searching for the primitive, fundamental, unchangeable something from which all else was derived. "Greek philosophy began as it ended, for what was lasting and abiding in the flux of things."[1] Thales postulated water as this abiding something, Anaximenes ἀήρ or mist, Heracleitus fire, which, however, could not exist without water, Empedocles, earth, air, fire and water. Others asserted one or a combination, but in all these theories water played the chief, or at least not unimportant rôle in answering Thales conundrum.

Sacred Waters.

We have shown how water came to be regarded as possessed of life-giving powers through its connection with the growth of vegetation. Living or running water came to be regarded as of special sanctity. Early civilizations largely inhabited countries having periodic rainfalls, so that with the rainy season and overflowing streams, the apparent visitation of some supernatural powers were particularly noticeable. Gradually certain streams, lakes, pools, wells and fountains, became set apart as sacred. The sources of streams were held as particularly sacred. Temples and other sanctuaries were frequently erected on the banks of streams, and the stream formed an important part of the *sacra* of the place.

We have evidence of the sacredness of many rivers in the Orient. The Phœnecians and the Carthaginians held many rivers to be divine. Belus, Adonis, Æsclepius and the Kishon, were all held in veneration; also the pool of Aphaca, which was the most famous of all holy places. Several of these holy places were named from the ancestral gods. The river Tripolis is still called the Cadisha, or holy stream. The Jordan, in Biblical times, was the sacred stream of the Hebrews, as were the Abana and Pharpar of the Syrians. In Damascus the Barada was sacred, and figures of the river-gods Chrysorrhoa and Pegai often appear on Damascene coins. These gods were probably prominent in religious worship. The Euphrates was sacred to the Syrians, and bore an important part in the ritual of Hierapolis. From the river the goddess was thought to have

[1] Burnet: Early Greek Phil., p. 13.

been born. The Aborrhas or Chaboras, the chief tributary of the Euphrates in Mesapotamia, was held sacred as the place where Hera (Atargatis) bathed after her marriage with Zeus (Bel). According to tradition the Orontes was carved out by a dragon which disappeared in the earth at its source. The river Cadas bears a name which implies its ancient sanctity.

Besides sacred streams, fountains, waterfalls, wells, pools, etc., were regarded sacred. Each village in Syria had its own well and its own high-place or little temple. In Canaan they were generally outside of the villages. Sacred springs were generally sought in places to which long pilgrimages had to be made. Such shrines were Mamre, Aphaca, Dan and Beersheba. Sometimes they were within the temples, and again, as at Antioch, the water and the groves surrounding formed public parks where pleasure and religious observances were combined.

Both legend and religious ritual give evidence that, at least in earliest times, the sacred waters themselves were deemed instinct with divine powers, and not that beings resided in them which possessed these magic gifts. The latter idea came in, but it is not the primitive one. Many of the legends attempt to explain how the waters became impregnated with supernatural powers. Many ancient accounts seem to indicate that the blood of the deity flows in the waters. In Paradise Lost, following Lucien in the Syrian account,

> "Smooth Adonis from his native rock,
> Ran purple to the sea, supposed with blood
> Of Thammuz yearly wounded."[1]

The red color of the river was supposed to come from the blood of the god killed. A fountain at Joppa was said to be colored from the blood of a sea-monster. In another class of legends the life of the water is derived from the blood of the gods who descend into them and die. This was said of the Euphrates, into which Hierapolis and Ascalon plunged and were changed into fishes. This, says Mr. Smith, is but another way of bringing the divine water or divine fish into harmony with anthromophic ideas. Aphrodite is said to have been born of the seafoam, which is but another way of saying that a deity had given its life to the water. Fish were taboo in Syria, and sacred fish were found in all sanctuaries. Sacred fish are still kept in pools at the mosques of Edema and Tripolis.

The early inhabitants of Switzerland probably worshipped the lakes. Ancient writers indicate that the Gauls, Germans and other nations, considered many lakes sacred. "According to Cicero, Justin and Strabo, there was a lake near Toulouse in which the neighboring tribes used to deposit offerings of gold

[1] Paradise Lost, I, 450, following Lucien in *Dea Syria*, viii.

and silver. Tacitus, Pliny and Virgil, also mention the existence of sacred lakes."[1] Gregory of Tours tells of a sacred lake on Mt. Helamus which was worshipped, and offerings of clothes, skins, etc., made to it.

Besides being sacred many of these waters were deemed to possess life-giving powers to all who drank of them or bathed in them. It was but an extension of the notion concerning the relation of rain and water in general upon vegetation to its effects upon man. Stories of fountains of youth abound in all lands, and the significance is great. It betokens the widespread faith that has been held concerning water as a life-giving agent, and the close identification of water with life. The magic draught of the fairy story, the Greek ambrosia, the Vedic Soma or amrita, which gave immortality, the Zend haoma, waters of strength and waters of weakness, rivers of life and fountains of youth, all seem intimately connected through the primitive notions from which they all arose. These draughts were the source of all strength and powers, panaceas for all ills. By imbibing magic waters, or bathing in them the old were made young, the infirm strong, and the blind to see.

In India there is a lake and river in which bathers could become as young or as old as they chose. Cambyses had heard of the long-lived Ethiopians, and despatched messengers to spy out their conditions of life. The Ethiopians were reported to live a hundred and twenty years, and the secret was that they bathed in a magic fountain. In the Hawaiian legend Tahita Kahiki, or the land *far away* may be found the *wai ora waiola*, or water of life, and the *wai ora roa*, or water of enduring life. These waters remove all sickness, deformity, or decreptitude from those who plunge beneath them.[1] The Sandwich Islanders have a tradition of a river in the spirit-world called Water of Life, which makes the aged young, and allows them to return to earth to live another life. Similar ideas have been found in the Malay Islands. Batara Gurr saves himself and the other gods from a poisonous drink by discovering a well of life. Nurtjaja compels the bandit Kabib to disclose to him the springs of immortality which flow beneath the caverns of the earth. Europe is not lacking in stories of miraculous fountains. "Ibu-el-Wardi places the Fountain of Life in the dark southwestern regions of the earth. El-Khidar drank of it, and will live till the day of judgment." Prester John wrote to Manuel of Constantinople in the 13th century that "at the foot of Mount Olympus bubbles up a spring which changes its flavor hourly day and night, and the spring is scarcely three days journey from Paradise, out of which Adam was driven. If any

[1] Sir John Lubbock: Pre-Historic Times, p. 222.

man drinks thrice from this spring he will from that day feel no infirmity, and he will as long as he lives appear the age of thirty.[1] Sir John Maundeville is said to have identified the mountain a century later as Polombo, near Ceylon. (Tylor gives it as Mt. Cytec.) He wrote that there "is a fayre Welle and a gret that hathe odour and savour of all Spices; and at every hour of the day he changethe his odour and his savour diversely. And whoso drynkethe 3 tymes fasting of the Waters of that Welle, he is hool of alle maner of sykenesse that he hathe. . . . . And men seyn, that that Welle cometh out of Paradys; and therefore it is vertuous."[1]

During the Middle Ages the belief was current that one who bathed in the Euphrates in the springtime would be immune from disease the remainder of the year. This power also extended to the vegetation along its banks. Near the sacred Belus grew the colcasium plant which healed Heracles after his combat with the Hydra. Ezekiel speaks of the sacred waters that issue from the New Jerusalem, giving life wherever they went. The leaves of the trees along its banks were believed to have medicinal virtues. The fountain of youth was a much sought for object even in subsequent times. Ponce de Leon is said to have searched long and anxiously for it among the Bahamas, and the everglades of Florida, and even penetrated the New World as far as the Mississippi River in search of that which would rejuvenate his ebbing powers.

Healing Waters. Belief in the curative and even life-giving powers of certain water has persisted down to the present time. "The healing power of sacred water is closely connected with its purifying and consecrating power, for the primary conception of uncleanness is that of some dangerous infection; originally an infection of holiness, but later on of impurity."[2] (Studied more in detail later on.) There are numerous records of enchanted wells until recently, and possibly still regarded as possessing miraculous powers. Great Britain, Scotland and Ireland, furnish them in great numbers. Among the most noted was St. Winifred's in Flintshire, Wales. Its waters were deemed almost as potent as those of the pools of Bethesda. All human ills were supposed to be relieved by drinking from it or being bathed in it. The spot from whence the spring issues is the spot upon which St. Winifred's head fell when struck off by Prince Caradoc. It has many visitors to this day. In 1635 Sir George Peckham prolonged his devotions too far, "having continued so long mumbling his *paternosters* and *Sancta Wini-*

[1] W. Robertson Smith: Rel. of the Semites.
[2] W. Robertson Smith: Rel. of the Semites, p. 68.

freda orea pro me, the cold struck into his body, and after his coming forth from that well he never spoke more."[1]

Hither came Wm. the Conqueror, his grandson, Henry II, and the first Edward; here, too, many of the Gunpowder Plot conspirators, and later James II. In 1876 the Duke of Westminster leased the well to the corporation of Holywell for a thousand years at a sovereign a year. At a recent date the following articles left by cured patients might have been seen by the curious visitor: 39 crutches, 6 canes, a hand-hearse, and a pair of boots. It is said of the two wells at Newton, near St. Neots, that "never went people so fast from church, either unto a fair or market, as they go to these wells."[2] In the parish of Wembdon, during the reign of Edward IV, immense concourses of people flocked to St. John's Well, and were said to be restored to health through its curative properties. With Chader Well, on the Island of St. Lewis, and also a well in Dumfriesshire it was either kill or cure: if convalescence did not immediately follow, death did.

Sacred wells were often the mediators in the transference of disease. At St. Elias's Well, Denbighshire, disease is transferred by casting into the well a pin, along with a pebble, marked with the intended victim's name. If the victim hears of it disease often occurs as a result of suggestion, but believed to have been transferred by magic. To remove the disease, the pebble is taken out and the victim's name erased from the magician's book.[3] At the holy well, Tubber Quan, near Carrick on Suir, the faithful were, and probably are, wont to resort on the last Sunday in June to supplicate St. Quam and St. Brogaum. If cures are to be granted they appear as two wonderful trout. In Wales epileptic patients go to St. Telga's Well, half way between Wrexham and Ruthin. The patient goes to the well after sunset, washes in it, and makes an offering of four pence. With a fowl under his arm he walks around the well three times, reciting the Lord's Prayer. He then sleeps all night in the church with the Bible for his pillow. In the morning another six-penny offering is made to the well. If the fowl dies the disease is supposed to be transferred.[3]

A few years ago a lady was sketching on the banks of a river in Ireland when she "saw a young girl . . . . leading a boy with a halter round his neck. When the pair reached the river the boy went down on his hands and knees, and so led by the girl crossed the river, bending his lips to drink. They then recrossed in the same fashion; he drank as before and she led. Then they went up the hill home. But presently

[1] W. G. Black: Folk Medicine, p. 103.
[2] W. G. Black: Folk Medicine, p. 39.
[3] *Loc. cit.*, p. 46.

they again appeared coming down the hill. This time, however, the boy led the girl, otherwise the ceremony was the same. 'Me an' Tom's very bad with the mumps,' explained the little girl, raising her hands to her swollen neck and cheeks, 'so I put the branks on Tom an' took him to the water, an' then he put them on me. We be to do that three times an' its allowed to be a cure.' And a cure did result."[1] In the early part of the century sufferers from the whooping cough, Catholic and Protestant, drank holy-water from a silver chalice in the hope of a cure. Nurses in Gloucestershire used invariably after public baptism to wash the infant's mouth with the holy water. It was said to be a safeguard against toothache. Such a value was placed upon this water that to prevent the people stealing it, the fonts had to be kept locked. In the Puritan portion of western Scotland it was looked upon as having power to cure many disorders. Further, it was a preventive against witchcraft, and eyes bathed in it would never behold ghosts.[2] It is said of the Borgie Well, at Cambuslang, near Glasgow:

> "A drink of the Borgie, a bite of the weed,
> Sets a' the Cam'slang folk wrang in the head."

On the 26th of June, every year, people flock to Saw Beach, Maine, for a healing dip which the waters are thought to provide on that day.

The Chinese do not like to have running water near their dwellings because it runs away with their luck. Scotch and English peasants believe it will bear away evil, and thus attach great value to it. Some think that to possess desirable qualities the stream must run east, others think south. The latter is usually regarded the more auspicious, being particularly efficacious in cure of witchcraft, a series of three mighty plunges being required for a cure. In Northumberland whooping-cough was cured by porridge cooked on a griddle held over a south-running stream. At one time the number of patients was so large that they could get but a spoonful at a dose.

Offerings. A further proof that the divine potency was supposed to reside in the water is shown by the form of religious ceremonies observed when offerings were made to the water. At Mecca and at the Stygian waters in the Syrian desert gifts were cast into the holy sources. Even at Aphacus, where the goddess Astarte was believed to descend into the waters, the pilgrims cast into the pool webs of linen and byssus, gold and

[1] J. G. Black: Folk Medicine, pp. 105-6, from Univ. Mag., Aug. 1879, p. 219.
[2] J. G. Black: *op. cit.*

silver jewels and other valuable materials. At Abraham's Well, Mamre, the heathen visitors cast into it libations of wine, cakes, coins, myrrh and incense, and illuminated the well at night with lamps.[1]

The custom of leaving rags and other worthless things at holy wells still exists in Ireland and Scotland as well as in remote parts of the world. A traveller in Persia found a tree near one of these wells hung with rags, which had been left there by people afflicted with ague. An African explorer found a tree hung full of rags. Old clothes, crooked pins, pebbles, shells, rusty nails, coins and other useless objects, all form appropriate offerings. The superstitious adoration was so great in the reign of King Edgar that it was forbidden by the 16th canon issued in 960, and it was condemned by the canons of St. Anslemus in the next century. In the reign of King Canute it was also interdicted by law. The practice has been limited since the Reformation. But there is still scarcely a parish in Ireland but has its own holy well.[2]

Oracular Powers. Holy waters have often been places of oracle and divination. They were supposed to indicate by some sign the favorable or unfavorable disposition of the divine power, and also to show whether certain gifts were acceptable or not. At Aphaca acceptable offerings sank, and unacceptable ones were thrown back by the eddies. The gifts deposited one year were thrown back the next, which was regarded as an ill omen, betokening the fall of Palmyra. In Greece holy wells gave prophetic inspiration to those who imbibed their waters. The oracle at Antioch was obtained by dipping a laurel leaf into the water. The oracular power of water has often been used to determine the curability or incurability of disease. In recent times it was customary at St. Orwald's Well, Holywell Dale in North Lincolnshire, Great Cotes, St. John's Well, Aghada, Cork and at other places, for people to try to discover by the floating or sinking of their shirt, whether one would recover or not. At their departure they usually hung a part of their shirt or a rag upon a bush near by as an offering.[3] One form of oracular manifestation is seen in the ordeals such as those used in trial of witches, which survived until recent times. In 1759 King James I published his [in] famous treatise on demonology. One of the methods prescribed for testing witches and sorcerers was to find an anæsthetic or analgesic spot on the body of a person, which was an indication of league

[1] W. Robertson Smith: Rel. of the Semites, p. 162.
[2] Gabrielle M. Jacobs, in Godey's Magazine, Feb., 1898; see also Brand's Popular Antiquities, Vol. II, for interesting chapter on sacred wells and fountains.
[3] W. G. Black: Folk Medicine, p. 73.

with the devil. The other was the trial by water. He wrote: "it appears that God hath appointed (for a supernatural sign of the monstrous impiety of witches) that the water shall refuse to receive them in her bosom that have shaken off them the sacred waters of baptism and willfully refused the benefit thereof."[1] In Hadramant when a man was injured by enchantment, all the suspected witches were brought to the sea or a deep pool, weights were tied to them, and they were thrown into the water. Those who sank were adjudged immune, while those who did not sink were declared guilty because the waters rejected them.[2]

In ancient religions it was criminal for persons ceremonially impure to approach sacred waters. Arabian women during menstrual periods were forbidden, for their children's sake, to bathe in the Dusares. At the present no one dares enter the valley of the Sheik Adi, which has a sacred fountain, without first ceremonial purification of person and clothing. Aristotle described a sacred oil-spring of the Carthaginians which would flow only for those ceremonially pure. Drinking certain water was often prescribed as an ordeal. The waters of Asbamæ, near Tyana, were sweet and beneficial to those who were truthful, but perjurers were at once afflicted with dropsy and wasting. Those who swore falsely by the Stygian waters died of dropsy within the year.[3] The Hebrews prescribed the drinking of holy water for women suspected of infidelity to their husbands. The guilty were immediately afflicted with dropsy on drinking it.

Many superstitions are still current regarding the supernatural power of water to bring harm to offenders. Sayings and proverbs are also prevalent which, though not now believed, represent actual beliefs of more primitive times. One of the oldest superstitions regarded it as certain that ill would befall the rescuer of a drowning person. The older form of the superstition maintained that the rescuer would himself be drowned. In this primitive conception it was believed that the water was a spirit, or contained a spirit or nixy who was naturally angry at being deprived of his victim, and who would revenge himself by drowning the one who tried to thwart him.[4]

To dream of deep or muddy water is regarded as a sign of trouble. Dripping water is a sign of death. It is lucky to have rain fall on a corpse or an open coffin. To cross water cures disease. A stormy wedding day betokens a stormy life. Several in my syllabus returns speak of superstitions concerning water that have affected their own or others' actions. An old

[1] Quoted by Baros Sidis: The Psych. of Suggestion, pp. 336-7.
[2] W. Robertson Smith: The Rel. of the Semites, p. 163.
[3] *Op. cit.*, pp. 163-4.
[4] J. Fiske: Myths and Mythmakers, p. 215.

man going to the beach met a girl and happened to brush against her. He was drowned that day, and the girl was much frightened lest the same fate should befall her. She was heard to remark that she must be careful and not go out too far when she went bathing or she would surely drown. A man in Sweden besought his brother not to cross a certain lake because some one was sure to drown there within twenty-four hours.

F., 41. About a year ago I experienced a great trouble. The following day it rained very hard. Seemed as if nature were weeping with me.

F., 18. My mother and another lady both dreamed on three different nights that I was in my canoe and was drowned. At the time the "flood gates" at Park Island were in a dangerous condition. My mother and her friend were sure I would be drowned, but the gates have been repaired, and I am still alive.

Fishers folk are very superstitious, and regulate most of their lives according to superstitious beliefs connected with the sea. Birth and death are dominated by the ebb and flow of the tide. This is illustrated by Dickens[1] in referring to the death of Barkis. "People can't die along the coast," said Mr. Peggoty, 'except when the tide's pretty near out. They can't be born unless its pretty nigh in—not properly born, till flood. He's a goin' out with the tide. Its ebb at half arter three, slack water half-an-hour. If he lives till it turn, he'll hold his own till past the flood, and go out with the next tide,' . . . . and it being low water he went out with the tide."

Water Deities.

Folk-tales and mythology of all lands abound with accounts of spirits who inhabit the water. They are a product of the universal animistic conception of the primitive minds which, failing to differentiate the non-ego from the ego, personify whatever happens to be an object of contemplation. "To the lower tribes of man, sun and stars, trees and rivers, winds and clouds, become personal animate creatures, leading lives conformed to human or animal analogies, and performing their special functions in the universe, with the aid of limbs like beasts, or of artificial instruments like men."[2] Water with its ceaseless motion and constantly varying shapes offered wide scope for the savage imagination.

Proteus, the old man who tends the seal of Poseidon, lived near the river Aigyptos, and each day, when the heat was greatest, he raised himself from the deep and rested on the sea-

[1] David Copperfield: Gadshill Ed., Vol. II, p. 10.
[2] E. B. Tylor: Primitive Culture, I, p. 285.

shore. He first became fire, then a snake, and finally assumed many aspects before returning to his original shape. He is said to be the Farmer Weatherby of Norse tales. The daughters of Nereus are the Nereids or Naiads, denoting water dwellers. The word Nereid is usually applied to those living in the sea,[1] and the latter to those inhabiting fresh water. The Greek goddesses, Nymphê or Latin Lymphæ, belong to the water. Lymphaticus, of Latin origin, corresponding to Nympholeptos, denoted the man smitten by the Nymphs. The Nymphê were sometimes divided into the Oreads and Dryads. In the Vedas they are the Apsaras or movers in the waters, and are endowed with wisdom. Besides the Nymphê there were the swan-maidens of Aryan mythology, who were akin to clouds and vapors. They swam about on seas formed by the blue heavens, and navigated by the self-guided barks of the Phakians. Thetis, although called a Nereid, is akin to Proteus, and can change her form at will. Poseidou is lord of the Thalassa or troubled waters. Okeianos, whose slow-moving stream no storm can ruffle, dwells in the far west. He is the source of all things. "From him flow all rivers and all the tossing of floods, all fountains and all wells. He is, in short, the spring of all existence."[2] Neptune is not strictly a god of the sea, but "the god of the clouds as the source of all moisture and water."[3] The Sirens are the witches of the shoals, while Scylla and Charybdis are the demons of the whirlpools. These are universally known, though under different names. Father Marquette met with the same belief among North American Indians with reference to a river whirlpool.

In Australia special water demons infest pools and bathing places. In the natives' theory of disease and death no personage is more prominent than the water spirit, who afflicts all who go into unlawful pools or bathe at unlawful times. The Greenlanders preserve animistic ideas concerning water. When they come to an untried spring an Angekok, or the oldest man, must drink first to free it from a harmful spirit. The Algonquin hunter says, "the spirit, he maketh this river flow." In all rivers, lakes or cascades, he believes there are spirits or mighty manitus. The Winnebagoes on reaching a body of water make a present or sacrifice to the spirits who reside there. The Peruvians used to scoop up a handful of water and drink it, praying the river deity to let them cross or to give them fish. Indians of the Cordilleras take a ceremonial sip before they will pass a river on horseback. Most African

[1] G. W. Cox: Mythology and Folk Lore, pp. 202-4.
[2] G. W. Cox: *op. cit.*, p. 204.
[3] *Ibid.*

tribes display well the rites of water worship. Among the Manikas every spring has its spirit to which oblations are made. In the Okra district, lakes, ponds and rivers, are worshipped as local deities. The Kaffirs and Tartars venerate streams as personal beings, or as the abodes of personal deities. Water holds a very prominent position in Finnish mythology, and nothing in nature indicates a more supernatural origin. Many of the sayings are still beliefs. The people call themselves Suomilainen or fen-dwellers, since they live in a land of swamps and marshes. Vapor baths are a national characteristic. Many streams and lakes are called holy, and receive sacrificial tributes. They have a current superstition that rivers may resent being enslaved when a new mill is being constructed,[1] just as the Romans believed that the Tiber was offended when chained by a bridge. Their chief water-god, Ahto, lives with his cold and cruel-hearted spouse, Wellamo, at the bottom of the sea. The general term for inhabitants of the water is Ahtolaisset, which means water-people. Allotar is the wave-goddess, Koskenneiti the cataract maiden, Wellanos the eternal people or people of the foam and billows. In the Vedas the river is personified. Sometimes they are the good mothers who watch over and care for the people. They were believed to control the growth of vegetation and animals, and were addressed as gods who must be propitiated to retain good will.[2] Norse and Russian mythology are full of allusions of river-spirits. Matthew Arnold's Forsaken Merman is undoubtedly founded upon the Russian myth in which Russalka, the drowned girl, marries a Vodyamy or Merman. The rivers of Russia are thought to have been persons. In Iceland seals are regarded as descendants of the Pharaohs who perished in the Red Sea.[3] Thus we might trace the prevalence of water spirits in all countries,—in the remote Orient as well as the Occident.

Mr. Tylor says[4] that to the savage mind "water acted not by laws of force, but by life and will; that the water spirits of primeval mythology are as souls which cause the water's rush and rest, its kindness and its cruelty; that lastly man finds, in the beings which can work him such weal and woe, deities with a wider influence over his life, deities to be feared and loved, to be prayed to and praised and propitiated with sacrificial gifts."

Paradise has usually been conceived by primitive people as a land beyond the sea, or a place surrounded by water, which must

[1] Max Müller: Cont. to the Sci. of Myth., I, 269.
[2] Kalavala, the national Finnish epic.
[3] W. R. S. Ralston: The Songs of the Russian People, p. 148.
[4] Primitive Culture, II, 209.

be crossed at death. The belief in an earthly paradise existed for centuries. "The features of this earthly paradise are for the most part similar to those familiar to us in Biblical description. It contained the fountain of immortality, from which sprang the four rivers which flowed to the four quarters of the earth. Purling brooks ran with the far-famed ambrosia."[1] This garden of delight was often sought, but only those in league with the gods could find it. Nereus, the sea-god, succeeded in piloting Hercules to the spot.[2] A 14th century Icelandic saga describes the position of the Deathless Land as across a strait which was to be entered by a stone bridge, guarded by a dragon. In Japanese legend there exists an Island of Eternal Youth.[3] It is beyond the horizon, and some fortunate observers have seen a wonderful tree rising far above the waves. The tradition was slow to die, and there are probably people who still believe, as did Sir John Maundeville in the 14th century, that the Garden of Eden exists somewhere upon the earth if it could only be found. After describing its cosmogenic position he relates that "in the highest place of Paradise, exactly in the middle, is a well that casts out four streams," the first is called the Ganges, the second the Nile, the third the Tigris, and the fourth the Euphrates. "And men beyond say that all the sweet waters of the world, above and beneath, take their beginning from the Well of Paradise, and out of that well the waters come and go.[4]

Rivers of Death. The "land of the blessed" is, as we have noted, quite universally separated from the abode of mortals by some body of water, now by a gulf, now the stormy sea, or again by a river which must be passed beyond the grave. The idea is preserved among all civilized people in sacred worship, by scripture and hymnology. The land of promise is quite universally across the "River of Jordan" or similar waters. Stories of "rivers of death" and "bridges of the dead" are to be met with in all tongues. The rivers Styx and Lethe have come down in our language as symbolic of death. There is a large quantity of Polynesian mythology relating to the gulf of death, though the bridge conception is lacking. Souls are obliged to cross this gulf in canoes or by swimming. In the ancient Orient the Vedic Yama, King of the Dead, crossed the rapid waters to guide our Aryan ancestors. The modern Hindoo is supposed to grasp the cow's tail when death comes, and is thus safely ferried over the dreaded river Vatarini. In ancient Egypt and modern Brittany Charon carried in his boat the

[1] Mrs. J. H. Philpot: The Sacred Tree, p. 136.
[2] *Loc. cit.*
[3] *Op. cit.*, p. 141.
[4] Travels in Early Palestine, p. 276.

procession of the dead to their long home. The ancient Scandinavians used to place their distinguished heroes in a ship, set it on fire and cast it afloat, or bury them in boats on shore.[1] The Finns, the Guinea Negroes, the Khonds of Orissa, and the Dyaks of Borneo, all have myths relating to rivers of death. Some North American Indians have tales of the bridge of the dead, but more frequently the water must be crossed in canoes to reach the "beautiful island." A storm always wrecks the wicked souls, and the heaps of their bones are to be seen under water as evidence of the fact. The Ojibwas are obliged to cross the Heaven Gulf on the way to the "land of spirits," and the wicked are drowned by their burden of sins.[2] Not even ghosts will cross living water. Witches, also, cannot do so, as we know in the case of Tam O'Shanter, they were baffled when he reached the Bridge o' Doon. Sometimes the milky-way and the rainbow are called the bridge of souls.[3] That the soul after death has a perilous journey is believed by many people. The Algonquins believed that the wicked perished in crossing the lake to the happy land. The Choctaws are said to walk a peeled log, and the wicked slip off into the boiling gulf. The Moslem's bridge of Es-Sirat was sharper than a knife-edge. The Australian natives, who are without an idea of God, believe that their souls after death fly to the clouds or cross the ocean to a distant land. Finns believed that those journeying to Tuonella were required to voyage over nine seas and over one river, the Finnish Styx, black, deep, and filled with hungry whirlpools and angry waterfalls.

There is great tenacity in old impressions, especially when connected with the sanctity of religious doctrines and feelings. The primitive beliefs relating to the location of paradise, the river or gulf separating it from the present, and the difficulty of passing this water still survive in poetry and hymnology. From a few hymn books I have collected nearly two hundred different phrases and lines relating to rivers of life, fountains of life, healing waters, havens of rest, crossing wild and stormy billows, shore beyond the river, etc. (See sec. on Water in Literature.)

Many curious customs have arisen as a result of the belief in rivers of death. Various ways of aiding the departed on their journey have been invented. The custom of placing a coin in the hand of the corpse with which to pay the boatman who ferries them across the river is still found among Scandinavians, the peasants at Altmatkt, Germany, and among some

[1] John Fiske: Myths and Mythmakers, p. 49; also Thalma, by Marie Corelli.
[2] E. B. Tylor: Early Hist. of Manhood, p. 362.
[3] John Fiske: Myths and Mythmakers, p. 57.

Irish at wakes, and among peasants in Cleveland, England. Some Hebrews in America are said to place a towel and soap with the corpse for use in crossing the river. In Brittany is the Baie des Ames (Bay of Souls), where souls are said to be launched for their voyage.

Water Itself Animate. Bearing in mind these early conceptions of primitive peoples regarding the supernatural powers and animation of water, it is not difficult to conceive how certain waters came to be sacred, while all folk-tales and mythology abound with accounts of waters of life, waters of strength, waters of weakness, etc. Nor will it be difficult to understand how by a slight extension of the idea of the supernatural power of living water came the conception of ceremonial renewal of life. Water was early ascribed as the dwelling-place of the gods, which is evidenced by survivals in the mythology of all countries. Mythology and folk-tales of all peoples abound with stories of nymphs, water-gods and goddesses, that reside in the waters. But evidence shows us that the more primitive conception regarded water itself as endowed with life. All nature suggests to the savage mind the conception of living force, and primarily supernatural life belongs to the objects themselves. W. Robertson Smith says of the Semites[1] "that the supernatural was conceived in a generally savage fashion, and identified with the quasi-human life ascribed to the various species of animals or plants, or even of inorganic things. For, indeed, certain phenomena of inorganic nature directly suggest to the primitive mind the idea of a living agent. . . . . Of all inanimate things that which has the best marked supernatural associations among the Semites is flowing, or as the Hebrews say, 'living water.' In one of the oldest fragments of Hebrew poetry the fountain is addressed as a living being"[2] (Num. XXI, 17-18.) We have previously noticed that water was conceived among many primitive peoples as being the source of all life to vegetation, and was also supposed to possess the power of restoring the dead to future life. These ideas, coupled with the knowledge of the function played by drinking water and, also, the fact that bathing refreshes and invigorates, led naturally to the belief that water externally applied produces magical changes in human life. From these early beliefs and superstitions, the religious and legal ceremonial bathings, the precursor of later baptismal rites arose.

[1] Rel. of the Semites, p. 126.
[2] Rel. of the Semites, p. 127.

LUSTRATIONS AND CEREMONIAL PURIFICATIONS BY WATER.

Many writers ascribe to ceremonial purifications an origin purely purgative in character, but we shall see that the idea of a supernatural virtue inherent in the water is the most prominent and original feature instigating the ceremonies. The usual medium employed in lustrations is water, though sometimes other substances, as sand or salt, were used in default of water. But undoubtedly in these cases, also, the agent was believed to possess more than simple cleansing properties. Salt, we are certain, was regarded as sacred by many primitive peoples.

One writer[1] has suggested in accounting for the ceremonial of Christian baptism that John the Baptist simply utilized an observance largely in vogue in Oriental countries. This is undoubtedly true of Christian baptism, but the idea that ceremonial purifications, prior to this time, arose owing to the dust and heat making cleanliness and comfort demand very frequent bathing of the whole body, is not tenable. This custom may have been prevalent in that country, and in that advanced stage of civilization found by John the Baptist, but ceremonial purifications and lustrations date back to remoter times, and are found among the most primitive peoples of to-day. Though the idea of cleansing is found in some or perhaps most of the ceremonials, yet many circumstances indicate other ideas connected with their origin. Certainly the idea of bodily cleansing is very remote among some of the most ardent disciples. Tylor states[2] that " these ceremonial practices have come to mean something distinct from mere cleanliness. Kaffirs who will purify themselves from *ceremonial* uncleanness by washing, are not in the habit of washing themselves or their vessels for ordinary purposes, and the dogs and the cockroaches divide between them the duty of cleaning out the milk baskets.

I believe, however, that instead of "coming to mean" as Dr. Tylor interprets it, that the ceremonials always have been only partially indicative of either literally cleansing bodily uncleanness or symbolizing purification from spiritual contamination. This meaning has been read into the facts in the light of modern baptism. But the older idea considered that the fetish could in some magic way renew, revive, rejuvenate, or even remove undesirable qualities. There was a belief in some inherent sacredness and magic power of the medium itself with little or no thought of the literal cleansing properties. From time immemorial the Ganges has been held sacred. Whoever bathed in it was cleansed and rejuvenated. The new-born babe

[1] A. W. Eaton: Heart of the Creeds, p. 135.
[2] Primitive Culture, p. 434.

is bathed in it, the sick sprinkled with its water, and the dead are plunged into it. It is carried to the Hindu houses and used in the temples. Now, were water symbolic of cleansing, only, any water would suffice. But it must be particular water, possessed of supernatural powers.

According to the legendary lore of the Greeks at the feast of Pales, the goddess of the flocks, shepherds purified themselves by washing in fresh dew, or by aspersion with consecrated water, sprinkled from a laurel or an olive branch.[1] The Scriptures record that 894 years B. C., Naaman was sent by Elisha to wash in the Jordan seven times to be cured of leprosy. After dipping himself seven times he came forth clean, with flesh like a little child. All these illustrate how, from the more primitive belief in the universal life-giving power of water, certain waters became set apart as sacred, and still possessed of curative powers and revivification. The symbolism of spiritual cleansing is plainly a later idea. The myths and legends of fountains of youth, waters of immortality, and later facts relating to sacred wells, rivers, etc., elsewhere described, corroborate this view.

Among all peoples ceremonial lustrations have been practiced long before baptismal rites, symbolic of spiritual cleansing were known. Long before the Christian era ceremonial purifications by water were common, and are also common among savage tribes at the present time who know nothing of baptism. Some savage tribes, it is true, know and practice baptism which they have learned from missionaries, but lustrations were known to them before the ceremony of baptism was learned. Sacred[2] and profane literature record that ceremonial purifications were to be observed after such occurrences as childbirth, theft, touching a corpse, adultery, the conjugal act, etc. Lustral water was placed at the doors of the Greek temples so that priests could purify the profane. Usually before entering a temple the hands and feet were washed. This was also true among the Hebrews.[3] The Hebrews were taught to regard running water as having greater power of purification than still water. The Incas of Peru to be purified from guilt bathed in the river and repeated the following: "O, thou River, receive the sins I have this day confessed unto the sun; carry them down to the sea, and let them never more appear."[4]

Among the Essenes and the Pharisees ceremonial bathing took up a great part of the time, so that it was very natural that John the Baptist should adopt that method of consecration in

[1] Baring Gould: Origin and Derivation of Rel. Belief, p. 398.
[2] Lev. XII, XV, etc.
[3] Ex. X, 29, 30, 40; Lev. 8, etc.
[4] Baring Gould: Origin and Deriv. of Rel. Belief, pp. 399-401.

Christ's time. It was simply making sacred a custom which had long been in vogue.

Infant Baptism. The lustration ceremonials for infants, prevalent among almost all primitive peoples, contain many suggestions that indicate belief in the magic power of water. In many cases these infant baptisms, as well as some of the ceremonials above noted, are for the purpose of removing *tapu* or *taboo* as well as cleansing. Among many tribes a new-born infant is taboo until ceremonial purification has removed the taboo. Some tribes do not baptize the infants until three or four months old. During this period the mother is also taboo. This does not refer to uncleanliness in the ordinary sense of the term. The taboo may refer in some cases to physical uncleanness, but the more primitive conception is that the object of taboo is in some mysterious manner associated with dangers arising from the presence of supernatural spirits, which are to be avoided as one would avoid infectious diseases. All taboos are produced through awe of the supernatural. The new-born, as the woman in childbed, or during her courses, or the person who touches a corpse, are all taboo because everything connected with generation of the species, and also with disease and death seem to involve supernatural powers of a dangerous sort. There is a type of taboo arising out of respect to the gods, where certain holy things must not be touched, but it is not because of the offense given. On the contrary, it is because the taboo will sanctify whatever it touches, rendering it unfit for ordinary uses. For example, "a slave or other person not sacred would not enter a *wahi tapu*, or sacred place, without having first stripped off his clothes; for the clothes, having become sacred the instant the precincts of the *wahi tapu*, would ever after be useless to him in the ordinary business of life."[1] "The fundamental notion," says Smith, is that the tabooed object "is merely not safe for ordinary people to use; it has, so to speak, been touched by the infection of holiness, and so becomes a new source of supernatural danger."[2]

In higher stages of thought the idea approaches the popular notion that the unclean object has become hateful to God, and should be shunned by all who wish his favor. But according to the more primitive and fundamental notion, holiness was contagious, and things that came in contact with such taboo needed purification just as much as distinctly corrupted objects.[3] To show that unclean things are tabooed because of the inherent supernatural condition supposed to be connected

[1] W. R. Smith: Rel. of the Semites, p. 432. Quoted from Shortland's N. Zealand.

[2] *Op. cit.*, p. 431.

[3] W. R. Smith: Rel. of the Semites, p. 431; also Isaiah LXV, 5.

with it, it is known that some of the most tabooed things, as menstruous blood, bones of the dead, etc., are the most potent charms. According to Mr. Smith, "the heathen Arabs used to tie unclean things, dead men's bones, menstruous rags, upon children to keep away the *jinn* and the evil eye."[1]

"Primarily purification means the application to the person of some medium which removes a taboo and enables the person to mingle freely in the ordinary life of his fellows. . . . . Purifications, therefore, are performed by the use of any of the physical means that re-establish normal relations with the deity and the congregation of his worshippers—in short, by contact with something that contains and can impart a divine virtue. For ordinary purposes the use of living water may suffice, for, as we know, there is a sacred principle in such water."[2] Blood, also, in its most primitive sacrificial idea was not used to wash away impurities, but to carry to the worshipper something of holy life. The idea of expulsion of an impurity is perhaps involved with the adding of sanctity. The evil may be dispossesed by inoculation with a more desirable life. This idea is seen in the Catholic Church in the exorcism of devils from the catechumen before baptism.[3]

In southern Egypt the child is bathed for the first time on the 40th day. From that time on it is no longer taboo, but pure. The same custom is chronicled of many primitive peoples, *e. g.*, the Aryans, Turanians, Polynesians, Semites, certain tribes in the Canary Islands, some Negroes and Indians. Long before the Christian era among the Norwegian Lapps, a Finnish people, infant baptism was a national custom. At the time of the ceremony the child was given a name and consecrated to a good, lucky and prosperous life. After every disease this ceremony was repeated and the child received a new name. This probably symbolized a new birth, received through the sacred potency of water, after which the child lost its old name and identity, and consequently could no longer be found by the evil spirits. New Zealanders baptize the child when eight days old. All the women of the neighborhood dip branches in water and sprinkle the child. At the end of a month the child receives a second name and a new baptism. The Tohunga (priest) dips a green twig into water and sprinkles the child, at the same time repeating his blessing in such ancient language that few understand it. This would indicate its remote origin. In the northern part of New Zealand the child is

[1] *Op. cit.*, p. 429.
[2] W. R. Smith: Rel. of the Semites, pp. 405-6.
[3] *Op. cit.*, pp. 406-7. For a general discussion of some of these topics see same work, *Taboos*, p. 143, *et seq.*; *Sacrifice*, p. 405, *et seq.*, *Note C*, p. 432.

dipped. The Papuans bathe (ceremonially perhaps) the child as soon as it can walk, when it receives a name. This is repeated several times. Many tribes do not bathe the child at all for months. The Uveans of the South Sea sprinkle the head of the child, and, like most primitive peoples, make the first bath of the child an occasion of festivity. In Java the child's head is shorn on the 40th day, and it is plunged into the river. Among the Battas the neighbor women await the birth of the child, which is immediately carried to the men, who take it to the nearest stream, give it a dip, while the father gives it a name. The Fiote Negroes baptized at three or four months, the child being dipped and sprinkled by all the community and given a name. The Basuto Negroes cook up some magic decoction and sprinkle the child with this. Upon the birth of a child among the Yoruba's of western Africa they send for the priest and ask for the name of some dead ancestor who intends to reinhabit the child's body. They look upon this as a rebirth of the soul. They baptize and sprinkle the child's eyes with sacred water. In the lowlands of Scotland a new-born babe was bathed in salt water and made to taste it three times. The solution was considered strengthening to the child, and also obnoxious to the evil eye.

All these ceremonial lustrations indicate the widespread belief in the regenerating and life-giving power of water, and also its efficacy in removing taboo, so that the child could enter into harmonious relations with its new existence. Although I shall not enter into the subject of Christian baptism, we can easily recognize the older materialistic conception in the symbolism of spiritual regeneration which water holds in Christian baptism to-day.

Water in Literature.

Space will permit only the briefest mention of the great influence that water has had upon literary expression. Poetry has kept alive the old animistic theory of nature. The poets, like children, are deeply animistic, and their expressions reflect the closeness with which they keep in touch with nature. Poetry is largely a conventionalization of child-like ideas. To quote Dr. Tylor there are moments in the civilized man's life when "he casts off hard, dull science and returns to childhood's fancy, [and] the world-old book of animated nature is open to him anew. Then the well-worn thoughts come back to him, of the stream's life that is so like his own; once more he can hear the rill leap down the hillside like a child, to wander playing among the flowers; or can follow it as, grown to a river, it rushes through a mountain gorge, henceforth in sluggish strength to carry heavy burdens across the plains.

In all that water does, the poet's fancy can discern the personality of life. It gives fish to the fisher, and crops to the husbandman; it swells in fury and lays waste the land; it grips the bather with chill and cramp, and holds with inexorable grasp its drowning victim."[1] Hence it is only a natural expression of animistic feelings to say

> "The bubbling brook doth leap when I come by,
> Because my feet find measure with its call."

Or with Michael Bruce in Lochleven that

> "The vales, the vocal hills,
> The woods, the waters, and the heart of man,
> Send forth a general song."

And with Joseph Warton, who added—

> "And that all nature conspires to
> Raise, to soothe, to harmonize the mind."

The ocean has always impressed the poets strongly. Barry Cornwall's characterization of the ocean expresses the sentiments of many.[2]

> "O, thou vast Ocean! ever-sounding Sea!
> Thou symbol of a drear immensity!
> Thou thing that windest round the world
> Like a huge animal, which downward hurled
> From the black clouds, lies weltering and alone,
> Lashing and writhing till its strength be gone.
> Thy voice is like the thunder, and thy sleep
> Is a giant's slumber, loud and deep.
> . . . . Oh! wonderful thou art, great element;
> And fearful in thy spleeny humours bent,
> And lovely in repose; thy summer form
> Is beautiful, and when thy silver waves
> Make music in earth's dark and winding caves,
> I love to wander on thy pebbly beach,
> Marking the sunlight at the evening hour,
> And hearken to the thoughts thy waters teach—
> Eternity—Eternity—and Power!"

The same writer says of the streamlet:[3]

> "Gently it murmurs by
> The village churchyard, its low plaintive tone,
> A dirge-like melody,
> For worth and beauty modest as its own
> May not its course express,
> In characters which they who run may read,
> The charms of gentleness,
> Were but its still small voice allowed to plead?"

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[1] E. B. Tylor: Primitive Culture, II, p. 209.
[2] Address to the Ocean.
[3] The Cataract and the Streamlet.

The poet Swinburne calls the sea "fair, white mother," "green girdled mother," "great, sweet mother," "mother and lover of men, the sea."[1]

James Russell Lowell regards the fountain as typifying great happiness.

> "Into the starlight, Rushing in Spring,
> Happy at Midnight, Happy by day!
> . . . . Ceaseless aspiring, ceaseless content,
> Darkness or sunshine, thy element:—
> Glorious fountain! Let my heart be
> Fresh, changeful, constant, upward like thee!"
> —*The Fountain.*

Dr. Biese[2] says of the peculiar charm of one of Goethe's scenes in Faust: "Die Herrliche Sommerabend-scene liegt im Keime mit den Worten: Ach demals, wie oft habe ich mich mit Fittigen eines Kranichs, der Ufer des ungemessenes Meeres gesehnt, aus den schäumenden Becher des Unendlichen jene schnellende Lebenswärme zu trinken und nur einen Augenblick in der eingeschränkten Kraft meines Busens einen Tropfen der Seligkeit des Wesens zufühlen, das alles in sich und durch sich hervorbringt." Again he quotes Pindar as saying:

> "Des Menschenseele gleicht dem Wasser:
> Vom Himmel Kommt es zum Himmel steigt es,
> Und weider nieder zur Erde Muss es ewig wechselnd."[3]

Dryden's writings are full of references to water.

Miss Reynolds says,[4] as illustrative of Dryden's use of similitudes drawn from water, note the following: "Revenge and rage are sudden floods; joys are torrents that overflow all banks; contending passions are tides that flow against currents; fame is a swelling current; anger is a dammed-up stream that gets new force by opposition; a ruined life, destroyed fortunes are shipwrecks; love is like springtides, full and high, or like a flood that bursts thro' all dams, or like a stream that cannot return to its fountain, or like the tides that do not turn; the disappointed lover dies like an unfed stream; the mind of a capricious tyrant is like a vast sea, open to every wind that blows; the army of the enemy comes like the wind broke loose upon the main; an obdurate foe is as deaf to supplication as seas and wind to sinking mariners; an open mind is a crystal brook; grief undermines the soul as banks are sapped away by streams; the voice of a mob is like winds that roar in pursuit

[1] See Dr. Chamberlain's Child and Childhood in Folk Lore, p. 39.
[2] Alfred Biese: Naturgefülhs, p. 385.
[3] Alfred Biese: Naturgefühls, p. 390.
[4] Myra Reynolds: Treatment of Nature in Eng. Poetry, pp. 28-9.

of flying waves; unspeakable anger is like water choking up the narrow vent of the vessel from which it is poured; and so on through a long list."

Religious rites and ceremonies are great conservators of ancient thoughts and customs. In hymnology we find innumerable metaphorical expressions of former literal beliefs. From a very few books I have collected nearly two hundred such verses, of which the following are typical:

> "Behold I freely give, The living water, thirsty one,
> Stoop down and drink and live."
> "When death's cold, sullen stream
> Shall o'er me roll."
> "Safe into the haven guide. . . . ."
> "Bear me o'er life's fitful sea."
> "Till I reach the golden strand,
> Just beyond the river."
> "There's a precious fountain,
> Free to all a healing stream."
> "Foul, I to the fountain fly."

Feelings of People at Present Toward Water.

In the light of the preceding investigation let us consider the reactions of people toward water at the present. To carry out this study a syllabus (M. XV, Water Psychoses) was issued in February of the present year. Only a part of the list of questions contained in the syllabus have been considered in this paper. To some others the returns were too meagre to furnish any important data; others may be worked up in a subsequent paper. About 800 individual papers, some covering as many as 20 pages of letter paper have been considered in this report.[1]

Feelings Toward Water in General. Many like to be near water, and to watch it because it makes them feel happy, or because it has a "soothing effect." Some have "feelings of reverence such as they feel nowhere else, and they wish to be noble and pure." To some it "seems like a friend," "a great comfort," others "feel like confiding to it their sad thoughts."

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[1] I am under great obligations to the following persons who furnished large numbers of returns from their pupils: Professor Will S. Munroe, State Normal School, Westfield, Mass.; Professor Lillie A. Williams, State Normal School, Trenton, N. J.; Professor E. J. Swift, State Normal School, Stevens Point, Wis.; Principal E. M. Beaman, Fairchild, Wis.; Principal E. H. Cassels, Tomah, Wis.; Superintendent R. B. Dudgeon, Madison, Wis.; Principal E. L. Bolton, Tunnel City, Wis.; Principal Sarah E. Davies, Atlanta, Ga.; Miss S. Elizabeth Smith, Kaukauna, Wis.; Superintendent J. M. Barrow, Columbus, Miss. To the various assistant teachers, all the pupils, and those who sent individual returns, my obligations are also gratefully acknowledged.

Various reasons are given for liking it, such as: "it is so musical," "it affords such a variety of amusement," "so restful," "have natural instinct for it," "love it because it attracts me," "seems like human beings," "seems to soothe me," "seems to sympathize with me," "because it goes on its journey as a man does, sometimes placid, sometimes turbulent," etc.

The *time of day* and the state of the weather exercise a strong influence over the feelings. Bright, pleasant days bring feelings of "unutterable peace," "happy recollections," "joyousness," etc. When bright and windy some record feelings of "passionate joy, difficult to analyze because of their very intensity." To be near water in cloudy weather "makes me moody," "profoundly melancholy," etc. In the morning or at sunset a "keen delight" is felt. At dusk or in the moonlight "feelings of awe, wonder, sadness," "desire to be alone and not to be spoken to," "solemnity," etc. One records that if sky is dark and wind high "I feel as if I *must* let the water carry me somewhere—it matters not where, but somewhere away from myself."

Storms produce various effects. Some fear them, but more enjoy them, especially if they are used to being near water. Expressions concerning them are variously given, as: "the roaring and the rocking are pleasurable," "something about the vast amount of water with its easy, uncontrollable motion, ever changing, yet repeating the same forms that makes me exultant in its power," "was filled with the beauty and might of the waves," "one word, grandeur," "felt as though could scarcely breathe," "always feel as if water were alive and sending out its arms for prey," "seems like a great monster which would not hesitate to wreak its vengeance upon anything within its reach," "the rougher the sea the better I like it," etc.

Running water seems to produce a different effect from large expanses. As was noted elsewhere the Jews held running or living water in especial reverence. Small streams bring "a sort of dreamy, happy feeling," "an inward pleasure and happiness and excite to more vigorous action," "relief from sadness and reveries are of pleasant things," feelings of "jollity and fun." Brooks to many seem possessed of life—"like children, happy and gay," while rivers "typify greater maturity and exhibit purposeful action." Many record that they often steal away from all persons just to sit by a stream and watch it and listen to its music. They sit and meditate "upon the works of God." The beauties of ripples, eddies, color, its swiftness, its music, its majesty, all seem subjects for a poet's theme. One says that she "often fits words of poetry to the tune made by the rippling brook." A little girl of 5 said

brooks "must lead charmed lives, now flowing in the bright sunlight, babbling over the pebbles, now running through some quiet wood, where only the rustling of the leaves or the chirps of the birds disturb them."

Large expanses produce a quite different class of feelings. Such expressions as the following are very numerous: When viewing large expanses "I feel insignificant, stricken with awe, as though the supernatural were in the water," "makes me happy, contented, yet restless," "uncontrollable feelings of longing and half sadness," "sorrowful, especially if alone," "should like to be as pure as they are," "wish to always watch and never leave," "always loved the grand old ocean, and ever shall," "feelings less personal than when near small bodies, thoughts of a universal interest, of the God of the universe and of nature, rather than of a personal God," "enraptures me so I cannot help exclaiming at the grand spectacle," "awes me with its mightiness," "sad feelings increased," "desire to get to the place called the horizon," "wish to sail far away and explore unknown depths," "feelings of awe, reverence and solemnity," "it reveals nature's vastness and my own insignificance," "seems as if gazing into eternity," "feelings of sublimity; the absorption of my soul into the universal soul," "produce a yearning toward one far off divine event to which the whole creation moves," "Nothing so fair; so pure and at the same time so large, as a lake, perchance, lies on the surface of the earth," (Thoreau) "feel utterly powerless in its presence," "suggests power, deep thought, ability to keep grave responsibilities secret; representative of great persons, their silent yet powerful actions, compels me to submit to nature's plan and to realize that all its workings are in more perfect harmony than those of any individual."

Waves, *billows*, etc., are always objects of especial interest because of the activity and force displayed. The following expressions are typical: "make me feel as nothing compared with them," "ripples make me feel jealous; sometimes think of them as the laughter of children," "waves seem to be at play," "through waves nature displays her mighty power," "seem like great, lifeless monsters, moved by a mighty hidden force," "produce delight and admiration for their grandeur and beauty," "ripples make me think of our deeds,—sometimes good, sometimes bad; waves of our sorrows and joys,—how they swell and swell until they can grow no more, then suddenly burst," "remind me of waters of time, pessimists, shallow-minded men, unable to accomplish ends without friction; brute force instead of persuasion, selfishness, treachery."

To be on the water intensifies many of the emotions experienced when only looking upon the water.

The vastness of the universe, the power, beauty and grandeur of nature's hidden forces, the insignificance of individuals, the oneness of nature, the strength of the ties of kinship and friendships, the awful solemnity of being alone with nature probably never can be so forcibly realized as when in mid-ocean during a midnight storm. Brave hearts quake with fear, stalwart forms tremble, the pious and the blasphemous seek comfort and protection in prayer; all feel that the power of God is manifest and that his creatures must bow before his will.

When on the water "I feel nature's vastness and my own insignificance," "whenever alone with nature I feel how grand it is and how insignificant I am, but when on the water the feeling is much stronger," "have feelings of solemnity and think how soon the waves could swallow me up," "feel solemnity and reverence for God; that I am a part of this great world and that I have my duty to perform in making it beautiful," "in a boat I always feel caged," "have joyousness, solemnity, reverence, awe, and humility, but never real sadness."

Children's Animistic Conceptions of Water. The next three rubrics deal with the animistic conceptions of water which children have. We find that most of the answers are from children or are reminiscent experiences of older persons which refer to child life. The child, like the savage, conceives all nature endowed with life and it is only later at the approach of adolescent years and the dawning of self-consciousness that the differentiation between himself and surrounding nature becomes complete. Most children regard water, and in fact all nature, as endowed with life. Some ascribe to it animal life, others human life, and many talk to it. With few exceptions they think of it as talking but many do not think they can understand it. The older ones think of its animation in a more metaphorical way and not with the reality of childhood. In these childish expressions so frankly and candidly given we have the pages of the earliest stages of man's life opened to view. The savage heard the voice of nature talk to him with tongues understood only by the primitive mind; the child recapitulating the race history understands those same voices. The poet, like the child and the savage, penetrates what is invisible to ordinary mortals, and is cognizant of the same unseen powers. These he discloses to us through his versifications. To the ordinary mind these voices become hushed through the complex of psychic influences necessary to mature existence.

Water as Endowed with Life. 1. F., 12. Often think the water has wild life like animals.

2. M., 12. Think of it as a person; it seems as if it could talk.

3. F., 15. Seems as if it had life like a roaring lion.
4. F., 13. Appears to be planning to do some wrong.
5. F., 17. The noise of the ocean and of rapids give me a feeling that they have life.
6. F., 17. Never talk to water. It seems to have life but not like animals or persons; it gives one a different feeling.
7. F., 15. When it attempts to drown me I think it has life.
8. F., 14. The waves seem like snakes.
9. M., 14. The waves make me think they are coming to catch me.
10. F.. 17. Billows, eddies, ripples seem endowed with life. They seem to think then act. Often think of the waves as temptations.
11. M., 12. Think of the water as being kind of snaky.
12. M., 18. Reared in the country and always thought of the water as being somewhat of a friend to me.
13. F., 14. Seems alive; don't know what kind of life, but the waves seem to be groaning.
14. F., 18. Used to think it had life, but different from ours; it was always a puzzle to me.
15. F., 17. Used to think it had life like a person and was made to take care of little children.
16. F., 20. When small thought it had work to do, and that it hurried along so fast because it had n't time to stop.
17. F., 17. Used to imagine the water had life; knew that it really had n't, but liked to think it had and that it was like a person.
18. M., 18. When a child, frequently thought it had life aud was talking as it rippled over its stony bed.
19. F., 19. In a storm the waves and billows dash against one another and crowd and jostle each other as though their bed was too small for them.
20. M., 13. Think of water having life like a person.
21. F., 9. Seems alive, so human.
22. M., 12. Think it is like animals because so wild.
23. F., 11. Think of it having life like an intelligent animal.
24. M., 11. Think it like a person, because it is so bright and knows how to work.
25. F., 30. I am happier in the instinctive feeling that water has a kinship of life with me, than when I am under the rebuke of reason concerning such things.

Talk to Water. 1. M., 18. When small, I sometimes talked to water and asked it if it would be good and not wash away my water wheels.
2. F., 5½. Was sailing a boat; the string broke and the boat went sailing away. She said, "Water, if you don't bring back that boat I'll tell mamma." Another time was heard to say to the brook, "I wonder where you go to? Do you ever get tired? I know I should." She says water must have life or it could n't move. Thinks it feeds on grass and sticks. Thinks rivers and brooks talk, but she cannot understand what they say. Thinks it must be saying, "How happy I am! Nothing to do but play all day."
3. F., 20. Used to scold when the ocean washed my sand houses away, calling it "a mean old thing!" After building them up again, I would say, "Come on now and enjoy it!"
4. F., 12. Have talked to it in my mind, if not in words, many times and said I would like to plunge into it.
5. F., 15. I talk to it as if it were a person I love very much and tell it all my little troubles.
6. F., 41. As a child I said, "Pretty water, I like you. Where are you going? Take me with you."
7. M., 19. Never talked to water, but always recited a certain piece of poetry when near the shore.

8. F., 17. Used to ask the ocean to tell me what it saw way out from land and to tell me about the little girls it saw.

9. F., 18. Used to sympathize with water when rocks or stones were in its way, and would scold the stones and talk pityingly to the water.

10. F., 22. When watching waves chasing each other I have said to the one I wished to beat, "Oh, hurry, hurry!" Used to draw a line before my sand houses and say, "Now, you must n't come any further." When the houses were washed away, I said, "Horrid thing!"

11. F., 6. Scolded the river after a boy had been drowned. To punish it would not go near it for a week. When did go, thought the river was glad to see her.

12. F., 11. Never talked to it, but have often thought I should like to.

13. F., 10. Sometimes like to talk to it. Was sitting beside it and told it it made me feel cool and that I loved its little rippling music.

14. F., 18. Used to say, "Pretty, babbling brook, singing, laughing brook!"

The following paragraph gives some expressions that children think the water seems to use:

F., 10. "Ripple, ripple, ripple." M., 10. "Flip, flap, flip, flap." F., 12. "I am tired of running so long." M., 12. "For men may come, and men may go, but I go on forever." M., 13. "Come." M., 10. "I chatter over stony ways." M., 12. "Bubble, bubble, bubble." F., 13. "Come, bathe in this nice, warm water." F., 13. "Come along, we have no time to play." M., 12. "Roll on, roll on." M., 15. "I will swallow you up." F., 12 "Hiawatha, Wa-wa Tasi." M., 16. "Don't get near me or I'll take you out with me." M., 11. "Come, jump in." M., 13. "Won't you come in and have a swim." M., 14. "Let me get hold of you and I will swallow you up." F., 14. "I am stronger than you are." M., 11. "I am on my way to the ocean." M., 12. "I go on forever." M., 12. "I'm coming on through hills and vales and over stones to meet the ocean." M., 16. "Keep away from me. I'll drown you if I get the chance." F., 3½. After wading in the brook, told that the water said, "Oh, stay a little longer! Come along with me, I'll catch you." M., 10. "Trick, trick, trick." F., 11. "What part of you, little river, is the widest? and what kind of fish are swimming about in the water?" M., 10. "I would like to know your history and about your drifting ships." F., 12. "Have you had a pleasant jonrney? Do you expect to carry large ships?"

Water seems to be talking. 1. M., 12. Think it the most delightful thing to be near water, to watch it flow, and hear it tell of its wonderful adventures.

2. F., 15. I think the water seems to talk; it sounds like some sweet lullaby.

3. F., 18. In running it seems to be talking all the while.

4. M., 20. As a child, when playing in streams, I imagined the ripples sang, "Go home, go home!"

5. F., 18. The waterfalls seemed to laugh, but when dashing against the rocks I used to think it scolded because rocks were in the way.

6. F., 17. Thought the water answered what I said but thought I was too little to understand, but would when I grew older.

7. F., 41. It seemed to say it was very busy rushing on to the sea.

8. F., 20. Its music I hear, but it is a music entirely different to

my imagination from that of any human music — a music of nature, separate and distinct, as is also the wind's.

9. F., 17. At the beach the water used to seem to say, "Come on down, little girl, I love you." Once when I had ventured too far and my clothes became wet, I told my mother the waters had told me to come down and they would n't hurt me.

10. M., 12. Seems to be complaining, especially when there are rocks in a creek. Seems to be moaning when the tide comes in.

11. F., 19. When I first heard the ocean waves (at 13) I imagined they were saying something to us which we did not understand. Sometimes I thought them singing mournful songs. Always thought the waves were like queer people. Just as we were the inhabitants of the earth, they were of the water.

12. M., 10. Seems to say: "I have lived a hundred years and more, have fish, whales, snakes, and many other things."

13. F., 11. Seems to laugh on days when the sun is bright and moan sadly on a dark day.

14. F., 11. Think it talks, because trees talk. Think by their moaning they comfort the fish.

15. M., 12 It talks. Don't know what it says, but *it* knows.

16. F., 11. The largest bodies seem to talk and tell you great stories.

17. M., 13. Seems to be talking but not a language like ours; has a language of its own.

18. F., 11. Says "I work," and many other things.

19. M., 11. Some water seems to say "Follow me, follow me."

20. F., 10. Sometimes seems to tell me to bathe in it and it will refresh me. Also tells me of the journeys it takes.

21. M., 11. Seems to say "Come in and play, come in and play."

22. F., 17. Water was always talking to me, telling me of its little scrapes and trials and the fun it had.

Earliest Feelings toward Water. The general concensus of testimony relating to babies' actions on being first placed in tub baths, is that the water causes momentary fright when it first comes in contact with the skin. Almost without exception the verdict is that after the first shock and surprise are over babies take extreme delight in being in the water. This they manifest in various baby ways—by splashing about, by cooing and prattling, smiling and laughing, and by remonstrating against being taken out. After a few times at most the bath becomes a pleasurable event, and is looked forward to with keen delight. Of course, some exceptions are recorded, but they are very few indeed. When a little older, children often object to having their faces washed, but many reminiscent items indicate (although this question was not asked) that it is because children feel that it is a waste of legitimate playtime, and is not because of any objection to the water. The following answers are typical of great numbers received:

1. F. Mother says the first time I was put into a tub of water I did n't make a sound, but clenched my hands and stiffened my body.

2. An experienced nurse said most babies objected to their first bath, but usually changed.

3. F. Mother says when I was a baby I loved water and was still as a mouse when she washed me.

4. M., 7 mo. When put into the bath kicks and squeals with delight, but cries when his mother takes him out.

5. F. Mother says I enjoyed tub baths very much, and liked to play in the water.

6. F. Mamma says I used to jump for joy when she mentioned the word water.

7. M. Mother says at sight of water I used to want to jump right in.

8. F., 12. When about 1½–2 yrs. old, one washing-day, I was all dressed to go out, bonnet and coat on, I climbed upon the chairs and got right into the tub with all my clothes on. Did n't mean to be naughty: was always a good child, but it was because I liked water. (A little boy did the same thing.)

9. F., 14. When small was afraid of water. Thought only fish could stay in it.

10. M., 14. Have always loved to be in the water. Remember the first time put into a tub—was about a year old.

11. F., 17. As a child liked to paddle and wade in water because I liked the feel of it.

12. F., 18. When a child was very fond of being near water, but was always afraid of reptiles. Think all children like to play in water.

13. F., 23. Did not like to bathe when a child, but it was because of the cold when they took me out.

14. F., 10. Like to paddle and wade in water. Enjoy bathing but shudder at coldness. Earliest fears of water were because afraid of drowning.

15. F., 17. When a child loved it. Seemed to be my dearest playmate.

16. F., 20. Most enjoyable hours of my childhood were when we children went to the woodland brook to wade.

17. F., 14. Earliest recollections were of seeing some persons immersed, and I shouted "See them going into the pretty water."

18. F., 20. When about 12 loved to ride on rafts so well that I tried to construct one myself.

19. F., 17. When a child, during a storm at sea, would run away and just stand and watch it for hours from the shore. Never wanted to talk to any one. When all others were frightened, I was delighted. My love for the ocean is almost a passion: would rather be near it than anywhere else in the world.

20. F. Thought when water was happy it danced along in the sunshine, and when it was sad it was still. I was then sad, too.

21. F., 20. As a child loved small streams and always longed to lie down on the grassy banks and gaze upon the water as it danced along.

22. F., 18. Was fond of playing in puddles. Am told I used to sit under our old pump and pump water over myself.

23. F., 17. When I see streams always want to put my hand into the water.

24. F., 18. Was always running out in the rain and running away to the brook, where found, minus shoes and stockings, paddling around in the water.

25. F., 22. Many times when a child I ran away to go and play in the water. Had to be watched continually. Three times I ran away to the docks, fell off, and was nearly drowned each time, but all this did not frighten me away.

26. M., 7. So fond of the water almost impossible to keep him away from it. Would go swimming in deepest part of the brook as often as he could without his mother knowing.

27. F., 17. Earliest love for water was when very small. Father

took me in bathing and swam way out, while I was perched "piggie back" fashion. Thought it the nicest thing a little girl could do.

28. F., 20. At 3 my parents had hard time to keep me out of the water. After being dressed for the afternoon would wander to the stream to watch the boys fish and swim. Parents always knew where to find me.

29. M., 7–8. Always preferred companionship of water to children. Often begged to have a lunch and go and stay all day, returning only when sought. When he returned to the city would pine for the seashore and seemed to live only for the next summer. Was a different child when away from water.

30. F., 15. Likes water so well that when washing dishes she plays and dabbles in the water. Seems pleased and generally sings. (In one way, exceptional.)

31. M., 7. Forbidden to go near the water, but used to manage to go almost every day and remain in by the hour. In spite of all punishments this transgression continued.

32. F., 23. When 5 went to beach. Saw the waves and screamed with fright. Would not go in nor allow my mother to. She picked me up and in spite of myself carried me in. Soon liked and do yet.

33. F., 11. Loved the water in the river when I first went to bathe. Was very anxious to get into it.

34. F., 11. Like to paddle in it because I like to see the water splash.

35. F., 13. Like to wade and go as far out as I can without getting my clothes wet.

36. M., 12. Like to bathe in all kinds of water.

37. F., 11. Like to ride on planks and rafts because it has such a good feeling and is such fun.

38. M., 12. Love the water like a fish; don't know any boy who does n't.

39. M., 11. Like to wade and paddle because I like to get wet.

40. F., 14. Don't know of any one who does n't like to wade and paddle. Children think it a great loss if near the water and cannot go in.

41. M., 13. Like to ride on planks, and when way out in the river we push each other off to get a good ducking.

42. M., 10. Would often conceal his books underneath the piazza, and generally go to the water.

43. Was out with a boy of 7 in one of worst storms of sleet, and yielded to his coaxing to sail chips down the gutter. It was the noon hour and he forgot his dinner. Soon many little boys joined. Do not believe one of those boys would have willingly forsaken that fun for the best dinner that ever tempted a child.

Bathing. 1. M., 16. Says of course he likes to bathe in streams or he would not walk to the bay, two miles away, every day.

2. F., 15. Often walked a mile to take a bath in a stream.

3. F., 17. To be in water gives one a feeling of exhilaration.

4. F., 22. Used to enjoy bathing in fresh water. Generally feel the water on my skin with great pleasure.

5. F., 19. Before 13 did not care for the water. Then was taken rowing, and have liked it ever since.

6. M., 13. Am very happy when the boys say "let's go two-fingers."

7. F., 15. Like to paddle in water because the water has a feeling different from anything else.

8. F., 10. Love to paddle in shallow water when there are no snakes nor blood-suckers.

9. M., 12. Feels sorry for the children of the far North, who, though so near the water, cannot bathe in it.
10. F., 17. Enjoy bathing very much. Think it is because of the water upon the skin and the buoyancy.
11. M., 20. Used to like paddling in shallow water, but was afraid of deep water. Always shudder on going into deep, cold water.
12. F., 19. Always enjoyed plunge baths, though I shudder at the thought of going in streams because of the coldness of the water.
13. F., 22. As a child was so fond of bathing in streams that often went in three times a day.
14. F., 20. At the thought of going in used to shudder because I thought it so cold, but the first plunge over it was a pleasure for me.
15. F., 30. Enjoy a sea bath with a feeling of mixed pleasure and fear; do not like a plunge tub bath; can't quite raise my will to the point of putting my head under water, but when at the beach let the surf meet me more than half way. Much of the shudder is from the cold, but more, I believe, from dread of being submerged.

The last two rubrics give fairly representative expressions relating to being in the water. Although some do not enjoy bathing and swimming, yet the majority of the returns indicate a passionate love for it. Many of the dislikes noted corroborate the deductions made by Dr. Hall in his study of water fears. The thought of the coldness of the water on taking the first plunge or after getting out brings the "shivers" to many, and act as a deterrent factor. It is safe to assert that could all temperature conditions be regulated perfectly, few would hesitate about bathing. Long centuries of wearing clothing has sensitized the body to feel keenly the changes of temperature. Savages, peoples inhabiting warm climates, and boys accustomed to daily "swimming and sunning" through the summer forget all about the possibility of disagreeable sensations. Even with babes it is only the first shock that frightens, and then they love the water passionately, often crying to remain in. The first contact produces a shock upon the dermal sense organ, causing a gasp and often a tremor, but it is because of the newness and not the disagreeableness. Again, the fear of smothering from submergence as in 15 is frequent. Fear of snakes, blood-suckers, and other water animals (8), deep, dark water (11), motion of the water are frequently mentioned as deterrents, but the "feel" and buoyancy are always listed with the pleasureable and attractive features. It is a matter of every-day observation that most children are extremely eager to be in the water, to play and paddle about in it, or to play in tubs of water. After every summer rain they can scarcely resist getting out and splashing in the pools in which they caper and frisk about in high glee. If allowed to, during the rain they will run out hatless and shoeless and let the rain pelt down upon them. Many boys in the country have been known to get out of sight, strip off all their clothing, and take the keenest delight in staying out in the driving rain. The

beaches, river banks and brooks during the summer months could attest to boys' love for water. Under severest protest they will run away to go swimming, and undoubtedly more cases of school truancy in the summer are attributable to this attraction than any other. One gentleman of middle age says that nothing is so restful to him as to plunge into the water and float around, oftentimes upon his back, gazing into the soft blue sky.

This universal love for water seems not to be due to experience alone, for all babes exhibit it in their earliest days, if conditions are supplied. It seems partly instinctive and of more than recent philogenic origin, and at least suggests a survival of the old time life in an aquatic medium. This is not demonstrable, but the weight of all testimony is in that direction. How else can we account for the passionate love of children to paddle, to splash, ride on rafts, run out in the rain; for their intense delight in swimming, even going without meals, walking long distances, enduring severe punishments, etc., just for the sake of being in the water? Many of these characteristics are exhibited by adults when the conventionalities of civilized life can be thrown off.

Pedagogic Significance. The natural tendency of children to get near to nature, indicates that while children are passing through this animistic stage that they can be brought into sympathy with the great book of nature without appealing to artificial and esoteric interests. They already commune with nature and should be encouraged and aided in understanding and appreciating more of its beauties. At this stage it should not be minutely dissected and studied apart from its natural setting. The child idea of oneness and harmony should not be carelessly destroyed. Injudicious teaching may create ideas that the soundest philosophical teaching of maturer years will fail to correct. The unity of nature which the child mind and the savage instinctively apprehend should be strengthened, not weakened. Nature should not be dissected and sliced and teased apart until nothing related remains. By so proceeding all interest is destroyed and the most fundamental and important lessons to be taught are abortive. The child on looking at the ocean or river or streamlet, feels them to be sentient beings like himself only of a different form. Even older persons say they seem so, and some say they are happier in the instinctive feeling that water has a kinship of life with them than when conceiving it otherwise. The ocean's boundlessness produces feelings of nature's vastness and one's own insignificance. Awe, humility, and reverence, the basal ideas in religion, are prompted, as so many of the returns show, by gazing upon vast bodies of water.

The various forms of water are most eloquent teachers. They appeal to the child's imagination in a way that no human being could. So many say that they want to be alone by the water to contemplate, to reflect. Their thoughts are turned from the disunited artificial life, enforced by the usual modes of living, and turned toward the unity and harmony which they discover for themselves when brought into contact with nature. Contact with nature is a more genuine eloquent exhortation to a contemplation of the Divine than all the preachers without the aid of nature. When alone with the forests, the rocks, or the deep, for companions, one's thoughts turn instinctively toward the contemplation of the universal, which cannot but lead to a search for the primal cause, for the constant, the all powerful,—for God.

From a purely pedagogical point of view the study has much suggestiveness. The child that is impressed with the thought of "how large the world must be!" and with "wonder about what could be seen if the eye could penetrate space" has aroused in him the most fundamental conditions of the learner, viz., wonder and curiosity. A permanent interest of this general form is to be most earnestly sought in all instruction. To wonder what and why, and to determine to understand more, is the highest type of interest. It surpasses all the passing, definable, artificial interests. This is interest self-determined, and if cultivated will prove permanent.

Child life loves nature. These returns show that many of the happiest of childhood hours are spent directly in contact with it. To separate the child from nature is like separating the savage from his forest home. The child, like the race, may develop later interests in other directions, but the transition must be natural and gradual, and the feeling of oneness with nature should never be relinquished. From the wading and paddling and swimming in the brook, and from the sound of the merry music of brook and cascade to the more mature contemplation of the majestic ocean, there is a charm and a delight which are the rightful heritage of childhood and youth. To rob childhood of the beauties and teachings of nature is to do violence to the normal course of development. The childhood of the race was spent in delightful contact with nature; the child, ontogenetically recapitulating the phylogenetic development of the race, craves instinctively for communion with nature.

I am indebted to President G. Stanley Hall for the assignment of the problem, and for much sympathy and many helpful suggestions in carrying out the foregoing research. In this place I also desire to express my gratitude to the other members of Clark University who have aided me in many ways in prosecuting the work.

INDIVIDUAL MEMORIES.

By F. W. COLEGROVE, Honorary Fellow in Psychology, Clark University.

This paper comprises one of nine chapters which treat of memory or memories. The preceding sections contain (a) An Historical Orientation; (b) A Biological Orientation which treats of racial memory and traces the individual psychical memory through different stages of life from man down to the vorticellæ; (c) The Diseases of the Memory—an original study based upon new material; (d) The Relations of Brain to Mind; (e) Memories. The subsequent chapters treat of Apperception and Association, Attention and Interest, and the final chapter is a summary of the leading pedagogical principles suggested throughout the work. The purpose of this paper is to give the results of a study of the memories of normal people from nine months to ninety years of age.

At the outset a real difficulty is met which is well illustrated in the following extract from "Recollections of Childhood," by Sonya Kovalévski. She writes: "When I begin to sort out and classify my earliest recollections, the same thing always happens with me: these recollections disperse before me. At times it seems to me that I have found the first definite impression which has left a distinct trace in my memory; but as soon as I concentrate my thought on it for a while, other impressions of a still more remote period begin to peep forth and acquire form. And the difficulty of it is that I cannot myself in the least determine which of these impressions I really remember; that is to say, I cannot decide which of them I really lived through and which of them I only heard about later on,—in my childhood—and imagine that I recall, when, in reality, I only remember the accounts of them. Worse still I can never succeed in evoking a single one of these original recollections in all its purity; I involuntarily add to it something foreign during the very process of recalling it." She then describes a scene in childhood, and adds: "As I reflect upon the matter now, I think I must have been two or three years old, and that the scene took place in Moscow where I was born." After the first memory she recalls "a series of detached but tolerably clear pictures" as of "picking up pebbles," and "my sister's doll which I threw out of the carriage window."

So many people have had the experience described by this "marvel of mental development" that the question may fairly be asked—can most people ascertain their earliest memories with sufficient accuracy and certainty to render them trustworthy data for scientific results? In order to test whether the difficulty would prove insuperable, one hundred persons were personally interviewed, most of whom were more than sixty-five years of age. The results of these interviews were such as to lead to the belief that after all deductions are made there is a large residuum which is reliable. Moreover the very difficulty alluded to is explained, at least in part, by the hypothesis advanced later in this study. The questionnaire read as follows:

1. What is your earliest memory? However trivial, or childish, your earliest experience is wanted. Be sure that it is a memory and that no one has told you.

In 1, 2, 3, give your age at the time, at least the probable age.

2. In like manner, give your second and third earliest memories.

3. What is your earliest recollection of your (a) father, (b) mother, (c) sister, (d) brother, (e) playmates, (f) of any injury from a fall or a blow?

4. Of what four consecutive years have you the best recollection?

5. Of what four consecutive years, after the first four have you the poorest memory?

6. Can you state examples of false memories experienced? *e. g.* Have you recalled as real what you had merely dreamed, heard or read? Give, if possible, a case of transposed memory in which what happened earlier was recalled later, and what happened later was recalled earlier.

7. What book read before you were nine years of age do you recall best?

8. Do you recall pleasant or unpleasant experiences better?

9. What studies have best developed your memory?

10. Give a condensed account of any case of loss of memory caused by a blow on the head, a fall or by disease.

11. Describe fully any aids to memory which you have found useful. How do you fix in mind and recall (a) figures, dates, dimensions, (b) forms of faces, microscopic structures, leaves, crystals, patterns, figures on the wall, carpet or dress, phrases in music and the cut of dresses? (c). How do you fix and recall passages of prose and poetry, declamations, and recitations? Why and how do you memorize fine passages? In learning foreign languages, describe devices for fixing new forms and phrases. Describe your system of keeping appointments. What memorandum do you keep, what book is used and how do you make entries? As a student, how full notes do you take in the class room? How would you teach a boy to remember things on time? Do you store up facts and dates, with no definite idea of how you will use them?

12. State cases in which the memory is so good or bad, that it weakens the other powers of the mind.

13. Describe cases of exceptional forgetfulness in old and young, stating whether it was due to distraction, abstraction, loss of mental power, or heredity.

As a rule, does defect in memory in children appear in the field of things done, known or felt?

14. As you advance in years do you find the interval between the power to determine whether you have had an experience and the ability to define, locate and name the experience wider or narrower? How is this in the kindergarten, high school, college, middle life, and old age?

The tabulation required almost incessant labor for five months. The results were first tabulated[1] upon two rolls of paper whose combined length was fifty-two feet by one foot eight inches in breadth. A second tabulation was made in which the memories (which could be readily studied from the first tabulation) were arranged under a large number of headings (over sixty), these headings being drawn from the papers themselves. Such topics were used as novel occurrences, repeated or protracted occurrences, gustatory memories, auditory memories, memories of father, mother, brothers, sisters, more distant relatives, other persons, deaths and funerals, sickness and accidents to self, sickness and accidents to others, memories of time, number, etc. Under novel occurrences or single impressions were included such memories as, seeing the ocean for the first time, drowning a cat, pet bird died, etc. By protracted or repeated experiences were included such memories as bringing water for mother in a little pail, the dress a person wore, etc.

To this topical syllabus 1,658 replies were received in time for tabulation. Of this number 1,372 were from white people; 605 males and 767 females. 182 were from negroes; 94 males and 88 females. 104 returns were furnished by Indians; 64 males and 40 females. The Indians represented 25 different tribes. The tabulations were made according to age in periods as follows: I, ages 1-4: II, ages 5-9; III, ages 10-11; IV, ages 12-13; V, ages 14-15; VI, ages 16-17; VII, ages 18-19; VIII, ages 20-29; IX, 30-39, etc. The last decade was practically 80-89, although a few males and one female 90 years of age sent returns, which were tabulated separately. The purpose in tabulating two year periods from 10-20 was to note the changes in memory, if any occurred, during this period of growth. The returns furnished many memories besides the first three. While the whole number of early memories did not differ essentially in character from the first three, the former furnish broader data for safe conclusions.

The youngest child whose memory was obtained was eleven months of age. She had apparently two definite memories. These experiences may not enter into the list of permanent memories. Yet a few adults state that they remember expe-

[1] I am indebted to my wife for the painstaking tabulations.

riences as early as one year of age,[1] and no definite limit can be set for the age of the earliest memories. The earliest memories of children under five years of age show the following range: The first number mentioned in each group of two representing males, and the second number females.

Novel occurrences or single impressions: fifteen, thirty-one; Protracted or repeated occurrences: sixteen, nine; Visual memories: twelve, sixteen; Auditory: four, two; Emotional: one, one; Gustatory; —, three; Motor: eight, nine; Tactile; one, two; Father: two, three; Mother: five, one; Grandparents: one, —; Brothers and sisters: two, one; Playmates: four, one: Other persons: three, two; Temperature: one, —; Topographical: seven, two; Logical: six, —; Clothing: five, one; School: —, two; Home: —, one; Visitors: —, two; Visiting: —, one; Running away: —, one; Corporal punishment: —, one; Dolls; one, nine; Sickness and accidents to self: five, three; Sickness and accidents to others: one, —; Deaths and funerals: one, —; Domestic fowls and animals: two, three; Fright: one, one; Colors: three, five; Playthings: four, four; Gifts: two, seven, Christmas: one, six; Playing: one, two; Activity of others: one; three; Attendant circumstances: one, —; Intellectual: one, —; Physical pain: one, —; Number: —, one; Trees: —, two; Mechanical: one, —; Teasing others: one, —; Time: one, —; Where slept: one, —.

It will be seen that the males have the greatest number of memories for protracted or repeated occurrences, for people and clothing. They excel also in topographical and logical memories. The females have the better memory for novel occurrences and single impressions, for Christmas, gifts, and, as would be expected, for dolls.

In the 5-9 period, the males again excel in the memory for protracted and repeated occurrences, the females for novel occurrences or single impressions. The motor memories here have a marked increase in the case of the females, and a slight increase for the males. The memory for all persons shows a noticeable increase with the females. For the males the personal memory improves for near relatives only. In the case of each there is a better memory for the activity of others.

In the next period—age 10 and 11—motor memories decrease for the females and increase for the males. Memories of near relatives increase in the case of both, while memories for other persons decrease. Memories of sickness and accidents to self and of playing are emphasized.

In the 12-13 period the percentage of memories for novel oc-

[1] This accords with the researches of V. and C. Henri. See popular Science Monthly for May.

currences decreases in the case of the females, while those for protracted experiences increase. Both males and females show a decrease in memories for near relatives, and an increase in those for playmates and other persons. Sickness and accidents to self are remembered less by males and better by females than in the preceding period. Memory for the activity of others increases in the case of the males and decreases in the case of the females.

In the period which includes those fourteen and fifteen years of age it is worthy of note that the motor memories nearly culminate for the males, but decrease in the case of the females. These memories seem to harmonize with the psychical and physical life of the period. Mischievousness and destructiveness are well remembered. The males have a decrease in the proportion of memories of novel occurrences and an increase in those for repeated occurrences. The reverse is true in the case of females. The males show a marked decrease in memories for relatives and playmates and an increase in those for other persons. Topographical memories increase in the case of each, as do visual and auditory memories.

In the period 16-17 the relations are again reversed so far as novel occurrences and protracted experiences are concerned, the females showing an increase in memories for the latter and a decrease for the former. In the case of the males the opposite is true, and the percentages become essentially the same as in the period 12-13. The females show a slight increase in memory for all near relatives and playmates, and a greater increase in memory for other persons. The males show an increase in memories for playmates and relatives, and a decrease in memories for other persons. The females have a marked increase in the memory for fears, the males for the activity of others.

In the period 18-19 there is an increase in the visual memories for each sex, and the auditory memory of the females improves. The memory for the activity of others shows an increase in the case of each, and it is strongly emphasized for the males. The females excel in the proportion of memories for protracted or repeated occurrences, and the males in that for novel occurrences and single impressions.

Dr. G. Stanley Hall and Drs. Lancaster, Starbuck and others, have found that puberty exerts a great influence upon the entire psychical life. In order to test its effect upon memory the exact pubertal age was obtained by Miss Williams of 110 females who had answered my questionnaire. Of the 110 cases, in 37 puberty occurs in the period of best memory; in 9 it occurs in the period of poorest memory; in 50 it occurs between the periods of best and poorest memory; in 14 it occurs

after the periods of both best and poorest memory. In 16 cases it occurs at the beginning of the best remembered period. In 4 cases it occurs at the close of the best remembered period. In 5 cases it marks the division between the best and poorest memory. In two others it occurs at the close of the period of poorest memory.

The returns give evidence that the period of adolescence is one of great psychical awakening. A wide range of memories are found at this time. From the fourteenth year with girls and the fifteenth with boys, the auditory memories are strongly developed. At the dawn of adolescence the motor memory of boys nearly culminates, and they have fewer memories of sickness and accidents to self. During this time the memory of others persons and the activity of others is emphasized in case of both boys and girls. In general at this period the special sensory memories are numerous, and it is the golden age for motor memories. Now, too, the memories of high ideals, self sacrifice and self forgetfulness are cherished. Wider interests than self and immediate friends become the objects of reflection and recollection.

The decade 20-29 is perhaps to most people as important a decade as any. At this period there is a marked change in the memory content. For the second time the proportion of memories for novel occurrences and for protracted or repeated experiences is nearly the same in the case of males and females. The males show a noticeable increase, and the females a marked decrease in visual memories. The same is true of the auditory memories. The memory for grandparents nearly culminates in the case of the females, and increases in the case of the males. The females show an increase in logical memories, and a more decided increase in topographical memories than do the males. Memories of sickness and accidents to self decrease with the males and increase with the females, while in the case of both there is relative decline in the memories of sickness and accidents to others.

In the decade 30-39 memories involving reflection and thought seemingly ripen. The logical, intellectual, topographical and visual memories for the males culminate here, also those for time, number, colors and father. The visual and auditory memories of the females culminate, while the intellectual, logical and topographical nearly reach the zenith. Memories for joy, quarrels, pride, jealousy, Christmas, physical pain and weariness disappear. The predominant memories are of a thoughtful cast. This is a conservative period, as no new memories are introduced.

In the decade 40-49 memories for persons tend to fall away. One is almost surprised to find the motor memories of the

females ascend and reach their maximum. Their tactile memories also advance and culminate in the next period.

In the decade 50-59 the motor memories of the males culminate and again appear strong from 80 to 89. We have seen that they nearly reach their maximum at 14, and in all subsequent periods they are well represented. According to Ribot the motor elements are primary in all emotions, and they seem to be among the most abiding of memories. The memory of the males for physical pain and weariness culminates from 60 to 69; that of both males and females for school culminates from 70 to 79; and that of the males for wearing dresses from 80 to 90. The boy's first trousers are remembered best in the first and last periods of his life. In the last decade the chief classifications are still represented, but it is noticeable that the auditory and tactile memories entirely disappear in this period. Memories are no longer found for grandparents, sickness and accidents to self, gifts and Christmas. On the other hand visual memories and those for near relatives are well represented.

As already stated in the replies to the questions calling for the first three memories, a much larger number than three was frequently given. Moreover other questions called for earliest memories of relatives, playmates, etc., so that a much larger number of memories was obtained than the first three of each individual. White persons reported, as the second tabulation shows, 6,222 memories, 78 per cent. of which were novel occurrences or single impressions, and 22 per cent. protracted or repeated experiences. The males had 76⅔ per cent. memories for novel occurrences, and 23⅓ per cent. for repeated impressions. With them the memory for novel occurrences culminates in period VII, ages 18 and 19, when they constitute $83\frac{3}{5}$ per cent. of all memories. With females the memory for novel occurrences culminates in period III, ages 10 and 11, when they constitute 89 per cent. of all memories. They drop to $58\frac{3}{5}$ per cent. with the males during the two periods 70-79 and 80-89, but rise at 90 to $84\frac{3}{5}$ per cent. With the females they also drop to $58\frac{7}{10}$ per cent. in the period 80-89.

The memories of repeated occurrences in the case of the males culminate in the first period (ages 1-4), when they constitute $51\frac{3}{5}$ per cent. of the memories. They become $35\frac{3}{5}$ per cent. in period X, ages 40-49. With the females they are 22½ per cent. in the first period, ages 1-4, and do not form a greater proportion except during three periods: VII, ages 18 and 19, when they are $27\frac{3}{5}$ per cent., XI, ages 50-59, and XIV, ages 80-90, when they become $31\frac{9}{10}$ and $41\frac{3}{10}$ per cent., respectively, of the whole

The fact that different memories culminate at different periods

may be significant. In not a few instances they seem to bear a relation to the whole mental life of the period. In order to determine this relation more definitely we shall now consider the periods when the memories more frequently found become a chief factor and reach their highest percentage. The visual memories are 27⅓ per cent. of the whole for the males, and 31 per cent. for the females. In the case of each they are a large factor in the first period, 1-4, when the child is exploring the world. With both males and females they culminate in the fourth decade, 30-39. In this period observation is ripest. In the case of the males the percentage is low in the 8th and 9th decades—70-89, and improves in the tenth, as if second sight were obtained. The auditory memories become accentuated with the males in period VI, years 16 and 17, and culminate in years 20-29. With the females they become emphasized in period V, years 14 and 15, and culminate in years 30-39. The periods of culmination are epochs when the auditory sense is much used as a rule. Men and women are busy, "hear what is going on," and do not spend much time in reading. It is worthy of note that in the period 80-89 for females and the 90 period for males, an age when the hearing is poor, there are no auditory memories. The motor memories come in great profusion at 14 and 15 for the males. At this period the motor memory is intensely motor, of a break bone and accident nature. On the other hand with the females at this period there is an actual falling off of 4 per cent. in motor memories. The motor memories, however, in case of the males, culminate in years 50-59 by a margin of 3½ per cent. over the 14 and 15 period, and with the females reach their maximum at 40-49. This may not easily be explained, but it is a period of life when activities have fallen away little, if any, and achievement and the results of activity are the objects of reflection.

The memories of brothers, sisters and playmates, culminate in the seventh period for females, and in the eighth for males, and then steadily diminish until second childhood begins. The memory of females for the mother exceeds that of the males by 4¼ per cent., while males have a better memory for the father than females. The memories of the males for their grandparents reach the highest points at (a) 5-9, (b) 30-39, (c) 60-69; those of the females at (a) 5-9, (b) 20-29, and (c) 50-59, the years (a) when they have most to do with their grandparents in their own home, (b) when their children are small and their own parents first become grandparents, (c) when they become grandparents themselves. The natural interval of ten years between the ages of males and females in the last two cases may be noted. Memories for deaths and funerals are recalled by the females almost equally well in the years from 60

to 90, and are not strongly marked before this time. Those of the males culminate at 90, but are very marked from 70 to 79. Is it not true that the memories of any period are in harmony with the general psychical life of that period, and do they not to a certain extent partake of its qualities? These facts suggest that what is remembered does not primarily constitute definite memories, but a memory complex. From this complex, at subsequent periods of life, those parts are selected out and made distinct which are en rapport with what may be termed the memory tone of the period; *e. g.*, if the period be one in which the auditory sense is much used, or be one of great logical activity, auditory or logical memories will be prominent. This hypothesis explains the cases of individuals in whom certain types of memory are pronounced. It also explains those cases in which persons assert that they cannot single out early memories. "It is all one mass," they say. Such minds are little given to reflection upon the distant past. They have not tried to separate the single elements of the complex. When they consent to reflect for a time, they are usually able to differentiate single elements and to arrange them in serial order. Yet what these elements are will differ with the age of the individual or with his memory tone. The memories for sickness and accidents to self culminate for the females in years 12 and 13, and for the males in years 14 and 15. Sickness and accidents of others are best recalled by the females in years 14 and 15; by the males in period 12 to 13. Females have the better memory for sickness and accidents to others. Males have the better memory for sickness and accidents to self. The activities of others are best recalled by both males and females in the closing periods of their lives.

In the general average for the whole life it is interesting to note that the females have a slightly higher percentage of visual, auditory, gustatory and tactile memories than the males. The gustatory memory is $3\frac{7}{10}$ per cent. for the females, and culminates in the first period, while among the males it is 2¾ per cent., and culminates in period 5-9. Memories for odors are very few, being ¼ of one per cent. for the males, and $\frac{1}{18}$ of one per cent. for the females. The males have two per cent. more logical memories. The females have from 2½ to 4 per cent. better memory for mother, playmates and other persons. They have 7½ per cent. better recollection of brothers and sisters, and 7 per cent. less of topographical memories than the males. Motor memories, father, grandparents, gifts, playthings and fears, are about equally recalled by each, but the females have double the memories for playing. The female memory for dolls is $3\frac{2}{3}$ per cent., and culminates in the first period, years 1-4, when it is 22½ per cent. of all memories.

The male memory for clothing is 6 per cent., the females $7\frac{1}{5}$ per cent. The males have 7 per cent. of school memories, the females $5\frac{1}{2}$ per cent. The memories of the males for home are $1\frac{1}{2}$ per cent., of the females $\frac{9}{10}$ of one per cent. The males have nearly 8 per cent. of memories for domestic animals and fowls, which culminate in period 40-49; the females have only $2\frac{1}{4}$ per cent. of such memories, which culminate in period 50-59. Time has $2\frac{8}{10}$ of memories with each. Number memories are $1\frac{1}{4}$ per cent. for the males, and a little less than one per cent. for the females. Memories of colors are $4\frac{1}{4}$ per cent. for the females, $3\frac{1}{3}$ per cent. for the males. The males have $2\frac{2}{5}$ per cent. of memories of deaths and funerals; the females $1\frac{1}{2}$ per cent. Memories of trees are $1\frac{1}{4}$ per cent. with the females, and $\frac{4}{5}$ of one per cent. with the males. The following memories should also be mentioned: Picture taken; pride; visit to dentist; quarrels; storms; money; jealousy; shame; lie; selfishness; curiosity; birthdays; being lost; deceit; stealing; picnics; circus; parades and soldiers; praise; temperature; visiting; $4\frac{1}{4}$ per cent. for females, $2\frac{1}{4}$, males; visitors $2\frac{1}{4}$ per cent. for females, $1\frac{1}{4}$, males; reproof, which is remembered $\frac{1}{3}$ as well as corporal punishment; running away; mud pies; crying and grief; anger; attendant circumstances; fishing; swinging; hair; sliding; physical pain; fatigue; malice; losing things; being praised; enemy; birthday; laughed at; playing horse; imitation; where slept; destructiveness; being kissed; disobedience; church; wedding; surprise; jealousy; teasing; mischief; guilt: blood; charity; revenge; working; supernatural; love; sorrow. The last eight memories are found for the first time at senescence.

The average age for the three earliest memories at different periods under the age of 25 is shown by the curves here given. The continuation of the same curves during the remaining periods is described in Figs. 1 and 2. The three lower lines represent the early memory of the males, and the upper ones of the females. The heavy line represents the first memory; the broken line the second, and the dotted line the third memories. Distance to the right represents the age of the person reporting; distance upward indicates the age of the person at the time of the occurrence remembered. For the first memory during the entire period, it is less than three years. The first rise in the curve is naturally marked because it begins low at the age of one. It drops at $4\frac{1}{2}$ and five for the first two memories, which may be due to some acquired ability to reflect upon the past. Children under this age have not been given to reflection, and it is very difficult to get them to bring forth the memories which later years will prove that they already possess. There is a rise in all of the curves at adolescence which is emphatic in the case of four of them. This shows that from the age of 13 to 15,

Fig. I.

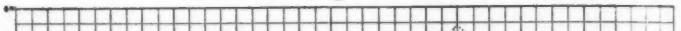
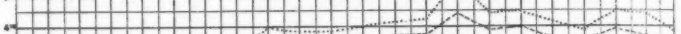


Fig. II.



boys and girls do not recall so early memories as others do before and after this period. At this period the present is large and the future makes a strong appeal. While the storehouse of memory is very rich now, perhaps the temperament or the psychical tone is now wanting in accordance with which painstaking reflection calls forth the earliest experiences. At any rate the earliest memories of boys at the age of 14 average almost four years, and for the girls it is more than three. At 35 the curve for the males descends and approaches two years, which is the average age for the first memory of boys at nine and five years of age. The curve for the earliest age of the females descends slightly at 30 and 40, and then fluctuates, rising slightly at 80 to descend again. The curve for the males rises at 70 and descends gradually, later terminating in the height reached at 6, 10 and 11.

The curves for the second and third memories call for no discussion as the representation is apparent. They show, however, a tendency to sympathize with the first. One fact seems clear from this study: There is not a progressive fading-out of memories as life advances and declines. The range of subjects recalled may narrow a little toward the close, but if a corresponding amount of data could be gathered, even this might be doubtful. The garrulous mode of talking prevalent among old people seems to be due to complete associations in which few petty details are omitted. Moreover the memory of the aged goes back practically as far as does that of young people, and is as clear and vivid. On the farm at my early home is a trout stream whose waters are clear and cold. In

childhood I saw the tree-tops and mosses mirrored in the clear waters. The stream has narrowed down a little owing to the cutting away of the forest. The branches now reflected there have changed somewhat, not by time, but by elements at work in time. If in old age I see them, the branches may be the same, but changed a little more. Such is the memory stream, narrowed a little, it may be, in the passing years, but the waters flowing as clear as ever from the same springs, mirror the old experiences.

Comparing the Indian males with the white males of the same period, the Indians show a higher percentage of memories for hearing, taste, mother and playmates, crying and grief, corporal punishment, trees, quarrels, and almost double for domestic fowls and animals. They have a higher percentage of tactile memories, and a smaller per cent. for dress and persons not relatives. The following memories are wholly or chiefly Indian: Fishing, snakes, squirrels, negroes, hunting (bow and arrows), lakes and streams, and tobacco.

Comparing Indian females with white females of the same age, the Indians have a larger percentage of auditory, gustatory and motor memories, also for father, mother, playmates, fear and dolls; much greater for crying and grief, and double the percentage for domestic fowls and animals. They have a smaller percentage of memories for persons not related, dresses and other clothing, fewer topographical and logical memories, and less for sickness and accidents to self and others, and for the activity of others. The following memories belong wholly or chiefly to the Indians: Lakes, rivers, wolves, coons, owls, fishing, skating and negroes.

The Indians who sent returns represent 25 different tribes, and may be considered fairly representative. Some of the tribes are in a low state of civilization, but many came from families of wealth and culture. Many of these memories may be termed crystallized racial experiences, and the question arises whether the memory tone is not modified by atavistic tendencies. As will be seen later, their memories for pleasant and unpleasant occurrences savor of racial experiences. The curves for the first three memories of both males and females average higher than those of the whites. That for the earliest memory of the males fluctuates between three and four until the age of 21 is reached. At this point it drops below 3, rises from 21 to 22, drops again, and with the curve for the second memory reaches its lowest point at 26. The third memory for this period is high. The curve for the earliest memory of the females reaches its lowest point by a rapid descent at 25. The second and third memories average 4 and 5, respectively, and are liable to reach the age of nine.

The curves for age, of the negroes, at the time of the first three memories show a higher average than those for the whites. The earliest memory of the males is usually found between three and four. The curve representing it is lower than 3 at the ages of 14 and 15; it also descends to three at the ages of 23, 24 and 27. It is high from 16 to 18, and culminates at 22. The second earliest memory ranges from 4 to 6, but at the age of 14 drops below 4. The curve for the third earliest memory fluctuates from 4½ to 9. The curve representing the earliest memory of the negro females descends to 2 at the age of 25, and at this period the second earliest memory descends to 3. The curve for the first is higher at the age of 26, when it is 4+. The curve for the third memory is noticeably high during the period from 14 to 16. The first and second are high from 15 to 17. The curve for the third memory is high again from 19 to 25, when it descends. The curve for the second memory, like that for the first, falls at 22, and both reach a very low point at 25.

The negroes do not seem to differentiate the memories from the memory complex until late in life. This may be due to the poverty of the mental experience in early life. The memory tone is monotonous. Further evidence of this is a strong tendency to remember by comparison. Such an event occurred in "Garfield's or in Harrison's administration," or "after I went to school." But the best educated negroes, as would be expected, have sharply defined and well differentiated early experiences. Their memories, too, have less of the grotesque character. The story of hardships, wrong and suffering is deeply imprinted on many memories.

It was to be expected that the negro females would place emphasis upon dress. The racial experience also crops out. One could hardly find an Indian or white child afraid of a candy sheep's head because the teeth showed, but this was the earliest memory of a negress.

The replies to questions 4 and 5 were tabulated together with replies to questions asked persons past fifty years of age regarding the decades best and poorest remembered. The years best remembered by males of all ages are the 16th and 17th, which are equally well recalled. The 15th year comes next, followed by the 19th and 14th in the order given. The poorest remembered year is the 8th, and the second poorest the 7th. From 46 to 50 there comes a tendency to remember the last 4 years or the last decade most poorly, and the red lines representing the best remembered years, and the black lines representing the poorest remembered years mingle together. After this period, as a rule, the last 4 years, or the last decade is least remembered. There are notable exceptions, however.

A few represent the whole life, after the first 4 years, as best recalled, and know no poorest memory. The statement is made by persons past 80 that they still recall passing events well, in which they become interested, and to which they give attention. Middle aged people frequently designate the years 20-25 or 25-30 as the best remembered, for the reason that important changes were then occurring.

The poorest remembered year for the females also is the 8th, and the next poorest recalled is the 7th. Their best remembered year is the 15th. At the age of 50 the lines representing the best and poorest recalled years mingle freely, and after this the tendency is to recall the last 4 years or the last decade with the greatest difficulty. Here, too, are notable exceptions. It is worthy of note that the years poorest recalled by all persons are the 8th and 7th respectively. For all persons the years best recalled are those characterized by the great psychical and mental awakenings of adolescent life. It is true that after 50, proper names, at least, are not so well recalled. An explanation given by the returns is that middle aged people have many more acquaintances and fewer intimate friends. The early memories abate little to the last. At every period attention and interest are the handmaids of memory.

The sixth question called for false memories. The returns fully justify the discussion in a previous chapter as to the influence of dreams. There are inverted memories, and defective localization in the past is fairly common. The period 16-19 is that in which false memories are most common. The experience at this age is fairly common to both sexes, but the males are able to give fewer definite examples. Yet, while false memories are more common at this period, no time of life seems free from them.

V. F., f., age 16. Read of robbery in paper, and told it as seen.

A. N., f., age 16. Told playmate a dream, and was punished for lying.

A. B., f., age 17. Four years ago I dreamed a person was dead, and supposed it was true until I met her a year ago.

M. C., f., age 17. Dreamed of a fire, and the next day asked if a friend went to it.

L. C., f., age 17. Dreamed that price of potatoes had gone up, that mother had told me so. Found out my mistake at the dinner table.

F. C., f., age 17. Dreamed mother had bought me a new dress. Looked for it all over the house.

M. D., f., age 19. Told teacher of a visit to Washington. Had never been there.

H. D., f., age 17. Dreamed uncle had come to visit us. Next morning asked mamma if uncle had come down to breakfast yet.

T., f., age 9. Mistook event near close of voyage home from Scotland to have been on the outward voyage.

M., f., age 17. Visited a friend five summers ago. The friend visited her seven summers ago. M. states that she made the first visit, and no amount of explanations and dates changes her mind.

T., m., age 19. Member of foot-ball team, in writing from memory a report of the games in which he played, often related events as occurring at the beginning of the game which, as a matter of fact, occurred later. This was brought to his notice by men who stood on the side lines and kept running notes of the game.

F. W., m., age 26. College graduate. Thought aunt told me something coming home from a funeral 8 or 10 years ago. Recently learned that she and I returned from the funeral in different carriages, and that it was told me by another relative.

A. F., m., age 18. Often thought I was at a feast in the woods before I was born.

R. C., m., age 15. Have an impression of having done something ages before.

C. B., m., age 17. Dreamed there was a train of cars in the closet for me, but found none.

E. L., m., age 14½. Dreamed I had a bushel of pennies, but could not find them.

A. H., m., age 19. Dreamed of landscapes which I never saw. They seemed real.

Some of the dreams may remain permanently as real, but they are apt to be corrected by experience.

Question seven called for the book read before the age of 9 which is best recalled. Books which appeal strongly to the imagination constitute a large portion of those mentioned. The influence of rhyme also apparently aids the memory. The books most frequently mentioned, 180 in all, fall under the heading of light stories and nursery rhymes. While short children's stories are included, the Mother Goose Melodies, Jack and the Beanstalk, etc., make up a large part of this heading. The younger people, especially, recall the pictured story books which they have seen in rich profusion. Here might have been placed Little Lord Fauntleroy, mentioned by 14, and Babes in the Woods, by 3.

The second division comprises novels which lead school books by the slight margin of 92 to 90. The list of novels is largely increased, however, by books mentioned separately, and which were not included in the above estimate. Such are Pilgrim's Progress remembered by 20, Black Beauty by 17, Uncle Tom's Cabin 14, Oliver Twist 3, Beautiful Joe 1, Tom Brown's School Days 1, Rip Van Winkle 3.

Fairy Tales by Grimm, Andersen and others, come next, 82, not including Cinderilla 25, Arabian Nights 5, Æsop's Fables 2, Blue Beard 8.

Returning to novels one separated from the general list is designated almost as many times as are all other novels. It is Robinson Crusoe mentioned 71 times. The Swiss Family Robinson is mentioned 25 times, Gulliver's Travels twice. Of other books Bible stories are designated by 43, didactic works by 11, biography by 14, history by 13, natural history by 16. Little Men by Miss Alcott is mentioned by 9, and Little Women by

16. A middle aged man writes that he recalls Little Men better than any book he has ever read. Essays are mentioned by 3, Moody and Sankey Hymn Book by 1. The Scrap Book and Brownies have one vote each. Peck's Bad Boy is mentioned twice.

The pedagogical significance is unmistakable. What appeals to the child's imagination interests him, and as a result remains in memory. Historical and didactic novels are most potent of the permanent influences. Scott and Lord Lytton, not mentioned here, if read early will be remembered. The Bible stories are the portions of sacred Scripture best suited to the child. Biography is well remembered and most instructive. There could be no better reading to appeal to the permanent interest of the young, than some of the best of Jowett's Dialogues of Plato.

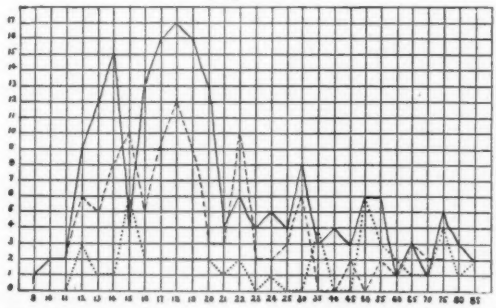
Pleasant and Unpleasant Memories.

"The thought of our past lives in me doth breed perpetual benediction."

A large number of replies were received to the inquiry, "do you remember pleasant or unpleasant experiences better?" The replies are illustrated by the curves here given.

The figures at the bottom give the age of the persons interviewed; the height of the curves gives the relative number of replies; the heavy lines representing those who remember the pleasant better, the broken lines those who remember the unpleasant better, and the dotted lines the number who could make no choice. It is the relative rise of the curves representing the pleasant and unpleasant memories, and not the absolute rise of one at any point or points that is significant.

Fig. III.



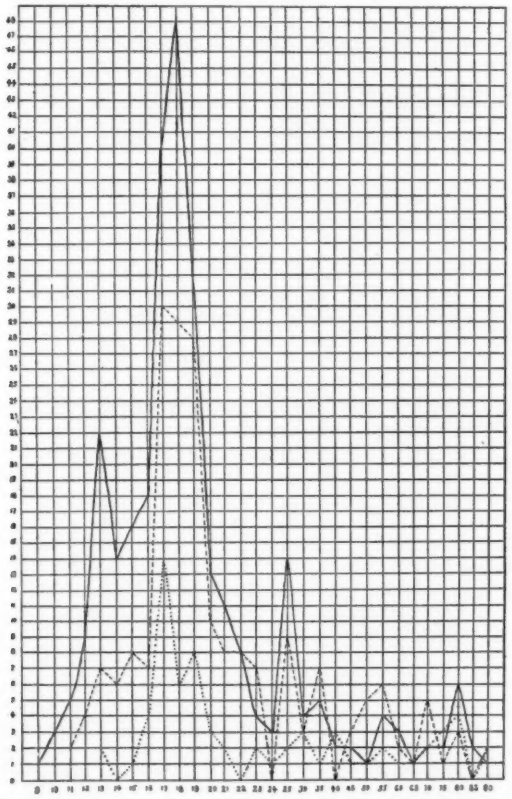
Curves representing the pleasant and unpleasant memories of white males.

As will be seen the pleasant and unpleasant memories of the male whites rise and fall together until the age of 21. At 22,

in the case of the males, the curve for unpleasant memories is the higher, after which the pleasant memories are in the ascendency. After the age of 30, unpleasant memories are little recalled by the males.

The unpleasant memories have a larger share in the woman's mental life than in that of the man.

Fig. IV.

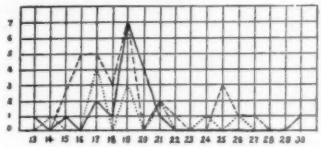


Curves representing the pleasant and unpleasant memories of white females.

The unpleasant memories play the important rôle in the case of the Indian and Negro males. One can hardly fail to see in it a suggestion of persecution and slavery. The Indian females show a slight tendency toward remembering unpleasant expe-

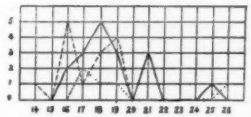
riences best, and share the sorrowful experiences of their

Fig. V.



Curves representing the pleasant and unpleasant memories of Indian males.

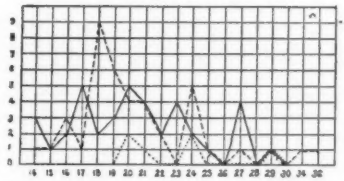
Fig. VI.



Curves representing the pleasant and unpleasant memories of Indian females.

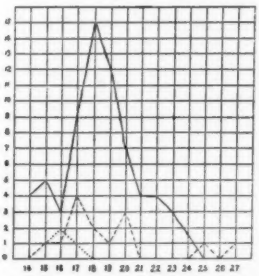
brothers. On the other hand, in the case of the negro females, unpleasant experiences play a very minor part indeed. With them a dress of striking color appears easily to efface grief.

Fig. VII.



Curves representing the pleasant and unpleasant memories of Negro males.

Fig. VIII.



Curves representing the pleasant and unpleasant memories of Negro females.

For many years the warning against memoriter work has been so persistent that one almost feels like apologizing for asking the question — "what studies have best developed your memory?" The thesis that memory ought not to be trained has been supplemented by the other that it cannot be trained. These ideas have made for advancement. They have also wrought injury. Have college students the ability to-day that they had fifteen years ago, to reproduce an author's thought and to think while upon their feet? The question in the topical syllabus called forth a great number of replies. Almost all of the studies in the curricula of High Schools, Normal Schools and Colleges are mentioned. We must allow for the fact that studies most commonly pursued will be mentioned most frequently. History easily takes the precedence, being mentioned 229 times. Some specify learning the dates, but with the great majority the work of fixing the salient points at different epochs, and wide collateral reading, are believed to have aided the memory. It is but natural that a close ally, geography, should come next. It is mentioned 147 times. Arithmetic comes next, having 124 votes. Many specify the committing

of the rules and tables. The tables for denominate numbers form an admirable memory drill. Geometry is mentioned 66 times, and algebra 27 times, while mathematics is mentioned 55 times. In certain schools where mathematics are well taught they have a large percentage of votes. Latin is mentioned 67 times, some add "when taught in the old way." No other language is to be compared with the Latin in the number of its adherents, although Greek is mentioned 8 times, (many more have studied Latin than Greek). French 7 times, German twice, and Language by 19. If this be true of foreign languages we are not surprised to find that English Literature has 74 votes, English grammar 47, poetry 45, general reading 36, recitations and declamations 30. Many state that their memory has been improved by memorizing gems of literature. Spelling is mentioned 27 times, science (general science) is mentioned; chemistry and physics are each named 5 times, physiology 14 times, botany twice, and zoölogy three times. Music is mentioned 8 times. Other studies named are Moral Philosophy 1, Psychology 11, Drawing 1, Catechism 3, Bible verses 9, Pedagogy 1, Political Economy and Civil Government 1 each. The Indians mention short-hand and phonography as helpful in training the memory. They also give other studies mentioned by the whites. The negroes, with two exceptions, refer to text-books and other books mentioned by the whites. It is probably true, as stated in another chapter, that nature assigns memory limits to each individual. There is as little doubt that within the limits assigned by nature the memory is susceptible to training, and is developed more by some studies than by others.

The request contained under heading 10 of the syllabus—"give a condensed account of any case of loss of memory caused by a blow on the head, a fall, or by disease," elicited a number of suggestive replies. These results are not significant as compared with the carefully collated results in chapter 3, studied under medical supervision. They show, however, that loss of memory due to traumatism and disease are fairly common and carefully observed by the folk consciousness. Instances given are as follows:

I. J., m. Head injured during foot-ball game. Could not remember signals.

Grandmother in usual health lost all memory for 1½ days.

M., f. Suffered nervous prostration, had to learn A. B. C.'s over. She afterward became a High School teacher, but was forgetful.

E. G., f., age 19. Crossing the ocean forgot all had learned. It came back at age of 15.

M., f., age 7½. Broke arm. Next day asked why it was tied up. Had forgotten the name of the pussy cat, etc.

B., age 8. Scarlet fever, forgot everything, and had to learn over.

A number of instances were given in which the secondary automatic movements of children were lost by disease.

E., m., age 2. After a fever he had to learn to walk over again.

Man fell. He did not know his own name for 2 years. After the death of his wife it all came back to him.

Man fairly educated, after typhoid fever had to learn to spell.

M. W. Fell down stairs three years ago. Cannot remember names since, nor can he identify persons.

F. Can recall nothing which transpired before an illness at 6.

Child fell from barn. Forgot being on the barn.

Quinine affects the memory of one.

L. L., f., age 15. Crossed Pacific Ocean at 4, sick, forgot Chinese language. It came back upon return to China 2 years later.

That the memory is affected by the state of the physical health is a widespread, popular belief, due to experience. A "close, stuffy room," and "lack of mental power due to fatigue," are mentioned as prejudicial to a good memory.

E. M., f., age 18. Broke limb at 9, took chloroform. Memory for years 1-9 poorer since. She attibutes it to the chloroform. Others believe that chloroform has affected their memory.

H. K., Indian, age 24. "I was playing foot-ball, and once while running with the ball I was tackled by an opponent, who threw me on the flat of my back, with his own weight on top of me, my head striking the ground at the same time or a little before my body did. I got up in a little while, said I was not hurt for I felt no pain, so they began playing. They called the signals and I stood still. I could not place the meaning of the numbers. I did not even know my own number, so after the play was made I stepped to the other 'half-back' and asked him what my number was. Before the fall I knew the signals as well as any man on the team. Of course I had to retire from the field. I could not remember from one minute to the next. I knew what I was doing, and knew at the time that I could not remember a thing. There were three days that I could not remember anything. It just seemed that a door would shut on everything I did, and in less than a minute I would be doing the same thing over again."

A well known pedagogical principle is that vivid impressions are easily recalled. With frequency, recency, and emotional congruity, vividness plays an important rôle in association. In order to test the abiding character of a vivid experience 179 middle aged and aged people were asked in personal interviews the following question: "Do you recall where you were when you heard that Lincoln was shot?" An affirmative answer required the exact location, an example of which is the following reply: "My father and I were on the road to A— in the State of Maine to purchase the 'fixings' needed for my graduation. When we were driving down a steep hill into the city we felt that something was wrong. Everybody looked so sad, and there was such terrible excitement that my father stopped his horse, and leaning from the carriage called: 'What is it, my friends? What has happened?' 'Haven't you heard?' was the reply—'Lincoln has been assassinated.' The lines fell from my father's limp hands, and with tears streaming from his eyes he

sat as one bereft of motion. We were far from home, and much must be done, so he rallied after a time, and we finished our work as well as our heavy hearts would allow."

Not all the replies were so vivid as this one, but only those were accounted as affirmative which contained facts as to time of day, exact location, and who told them.

J. P., age 76. I was standing by the stove getting dinner, my husband came in and told me.

M. B., age 79. I was setting out a rose bush by the door. My husband came in the yard and told me. It was about 11 o'clock A. M.

H. R., age 73. We were eating dinner. No one ate much after we heard of it.

J. T., age 73. I was fixing fence, can go within a rod of the place where I stood. Mr. W. came along and told me. It was 9 or 10 o'clock in the morning.

L. B., age 84. It was in the forenoon; we were at work on the road by K.'s mills; a man driving past told us.

Of the 179 persons interviewed, 127 replied in the affirmative, and were able to give full particulars; 52 replied in the negative. A few who gave a negative reply recalled where they were when they heard of Garfield's death. Inasmuch as 33 years have elapsed since Lincoln's death the number who made an affirmative reply must be considered large, and bears testimony to the abiding character of vivid experiences.

Many helpful pedagogical suggestions were received from High School, Normal and College students in reply to question 11. Figures are mentally represented as clearly as possible,—a "picture of them as they look printed or written." A child thought of the figures to be carried in division as "gone up in the attic." He would "call up attic to see if anything was there." One "locates them on a certain page of a book." Several "write them a few times." Association helps. A college student writes, "I associate figures with what is familiar. If I hear that Mr. A. receives $5,000 salary, I say to myself that is 5 times as much as my old school teacher got. After this the salary is easily recalled." Place localization, and association are chiefly relied upon. Some have a kind of mnemonic system, and group or reverse the numbers. One associates the figure 8 with a doughnut. 3.1416, the ratio between the diameter and the circumference of a circle is fixed by serial association, repeating the figures in order. 3.—1.4.1.6. (3, one 4, one 6). The same aids are employed for dimensions. The most efficient mnemonic aids for dates is to associate them with important events, *e. g.*, 1492, 1776, etc. Dates of minor importance are associated with these. Charts are recommended. Some make rhymes for dates, getting the idea, perhaps, from the way the presidents or the rulers of England are remembered. One sees figures in a winding row.

Faces are recalled by types. After fixing the type to which it belongs, the eyes, hair, nose, cheek-bones, complexion and scars are noted. A college student writes: "I try to trace a resemblance between a strange face and one I know." A middle aged woman takes careful notice of the hand. She has a poor memory for faces, but can often locate the person by the hand. A normal student writes the initial of the person or place on the left hand. After it has been erased she still visualizes it there. One analyzes the features. "If any feature resembles a well known face it is easily recalled."

Microscopic structures and crystals are fixed by drawing them. Drawing is the chief aid. Here, too, clear visualization counts. "I see them floating before my eyes." Localization in place is a help.

Leaves are remembered by the form, color, number of lobes, the veining, margins, and by comparing them with other leaves. Figures of wall-paper and carpets are associated with the room, house, or are localized in time. Here forms are also fixed by drawing, "even by tracing them in the air." The color, shape, and above all striking characteristics of figures are noticed.

Phrases in music are recalled by playing, or by attempting to play, or by humming the tune. College student, m., age 22. "I recall the time intervals and note the first part of the theme; I recall the rest by association." Female, age 17, normal student writes: "I remember phrases in music by thinking if they are similar to phrases in any selections that I have heard." Constant repetition and association of the selection with the person who played or sang it are helps frequently used. "If I get one measure as tone,—be it first or last,—the rest comes without effort." Female, age 34, recalls sounds, not appearance of notes. Her memory for sounds was strengthened by taking music lessons. One recalls music by an imaginary curved line going up and down with the tone. One thinks of whole rests as heavier than half rests, and consequently falling below the line. One boy thinks of the notes as Chinese climbing a fence. With another it is secondary automatic,—"my fingers remember the music." The Indians find that sheer determination helps them to remember music, as other experiences.

The negro males gave,—by sound, visualizing, position of notes on the staff, some initial note is the key to the whole, music just comes up. Negro females remember (a) phrases in music by accent, (b) by sounds, time and words, (c) where they saw them last, (d) by mental picture of the notes. The familiar mnemonic sentences are given for sharps, flats and keys: "God deluged all earth by floods," "Foolish boys eat

apple dumplings greedily," "Fred Coburn goes down after each boy."

It is worthy of note that some excellent musicians recall music better after an interval. They cannot immediately reprodnce it if they have enjoyed it intensely. Sometimes an interval of a day or two is necessary in order to recall it well. It is quite possible that there is a modification of the basilar membrane which serves as a basis for subsequent recall. Furthermore it is true that many people find that a time interval is necessary to recall well any experience. E. C., f., age 17, recalls better now what happened in all school grades than when she was younger. Male, age 20, "I can define and locate my former experiences better now than I could a year or so after they happened." Female, age 19, "I can recall now things that happened 8 or 10 years ago, which I could not recall 4 years ago." Apart from a maturer mind perspective seems to be necessary to many in order that they may have a good memory.

The cut of dresses is recalled by association with the person who wore the garment. New features are noted. The different parts, as neck, yoke and skirt, are studied by one. Association with place and person is the chief aid.

Passages of prose and declamations are memorized by paying attention to the thought. After the thought is fixed it easily clothes itself in language. Not a few, however, memorize mechanically, attention being especially paid to the beginnings and endings of sentences. Repetition and reading aloud are frequently mentioned. Clear mental representation and a purely local memory are of service. Male, 17. "I usually memorize by imprinting the object and its surroundings on my mind like a negative. In memorizing Lew Wallace's "chariot race," comprising 16 pages, I read it through twelve times. I imprinted the photograph of the page on my mind, and then read what I saw." In poetry the answers bear out the conclusions of Ebbinghaus and Müller and Schuman, as to the influence of rhythm. It plays the chief rôle. One is aided by fixing upon the initial letters of each line. Another gets the thought, "and the words which are so closely associated with thought in poetry come of their own accord." Repeating aloud is of service, but form and structure are usually mentioned as the essentials to be considered. Practice improves. One learns easily who memorizes a selection every day and rehearses all at the close of the week. A college student writes, "first of all a feeling of confidence is necessary in all recollection. Doubt breaks the train." The memory must be trusted.

Much the same suggestions are given as to the manner of memorizing fine passages. Slow repetition aids one or two.

The reasons given for memorizing these passages are (a) beauty of thought, (b) beauty of expression. "The author expresses the thought better than I can." "When depressed these beautiful passages come up and encourage me." Other reasons are: "To enrich my mental life," "prevents day-dreaming," "convenient when no book is at hand," "for pleasure and enjoyment" is an answer repeated frequently.

Few devices were given for fixing forms and phrases of foreign languages. Comparison with similar phrases and forms in the mother tongue is found to be serviceable. Even where the native language is as poor as the Indian this device is found useful. The less familiar are associated with the better known. The beginning of the list of German prepositions, aus, bei, mit, nach, etc., are associated by one with the phrase "the house by the meat-market."

A large number of devices are given for keeping appointments. Females change rings, insert paper under a ring, pin paper on dress, etc. There are other favorite mechanical devices. Chairs are turned over, and other furniture disarranged. A middle aged man hid his hat to remind him of an appointment. Next morning he hunted up another hat, but did not recall why the one usually worn was gone. One associates appointments with the hands of the clock at the hour fixed. Not a few find it necessary to repeat the appointment again and again. Others are aided by a memorandum. As a rule those who say that their memories are utterly untrustworthy do not use notes. Yet W., m., age 26, writes that the only appointment he has missed for years is one which he noted down. Female, age 16, writes, "to keep an appointment I write the first letter of the person or place connected with the appointment on my left hand. Even if it be erased I still imagine it there." Clear mental representation is the great help in such cases. Three visualize in colored terms. Female, age 19, recalls the letter A in black on red background. Female, age 21, "words seem colored. My name is red, my sister is yellow. I often remember by color." Male, age 18, "I remember figures by color."

There is a wide diversity of opinion as to how full notes a student should take, and almost all degrees of copiousness are indicated. Female, age 37, believes her memory was injured by taking full notes at the normal school. Again, "too many notes make the general idea of the lecture indistinct." One writes that the state of his health determines how full notes he takes. If the physical tone is low he is obliged to take more copious notes. Some are best aided by jotting down the headings and by giving attention unreservedly to the lecture. A normal student writes out very full notes, and never thinks

of the contents of the lecture until she leaves the lecture room. Some take "key" words with which the rest is associated. Concentration of attention and "hand and arm" memory are required as a rule by taking quite copious notes. To take few notes is a work of art, and the essentials must be seized upon. The consensus of opinions received would seem to favor few notes. Where full notes are taken they are not often reviewed.

The inquiry: "how would you teach a boy to remember things on time?" brought out a large number of specific directions, many of which were of a nature to make the fate of the lone Indian attractive by comparison. The normal students would have him keep a memorandum book; deprive of some pleasures, give tardy mark; keep after school as long as late; exclude from class and association with other pupils; if late at dinner, give very scanty meal; write down and fix things for him to do in a natural order; mark 0; be on time myself for an example; make him go and get what he had forgotten; tell him true story of boy in trouble on account of forgetfulness; punish if late, and reward for being on time; make him do two or three times as much when he wants to do something else; study the boy; exclude from school; make him write the thing forgotten 20 times; have him repeat what he was to do and when; make him take the natural consequences; whip; lecture; strengthen his memory by having him commit poetry; have him write several hundred times what he had forgotten; give him tasks to perform that could be done only at one time; teach the sin of forgetting; try to interest him; first, ask why, second, keep after school; strengthen his memory by giving him short lessons to learn; show him how it would affect his father's business if his father were not on time; "I once told a forgetful boy to be sure and forget, and if he did I would give him a pretty card. He remembered."

The academic and collegiate students favor corporal punishment. One states that it worked well when he was a boy. The Indians also suggest this remedy. A very sensible suggestion comes from a college woman: "If a boy could not remember things on time, I would try to give him opportunities for practice; I should try to form an association between the thing to be done and the required time or something which would happen then." The suggestions to study the boy, and make him take the natural consequences; try to interest him; and ask him why, are good from a pedagogical standpoint.

A large number of young people state that they store up facts and dates with no definite idea of how they will use them. This statement applies more to facts than dates. It is a trait more characteristic of young men than young women. Male,

age 20, writes: "I collect facts as I would dollars, expecting to use them in many different ways." While peering into the future, and uncertain as to what resources shall be called out, the young man stores up facts from all sources, with but little thought as to their use.

In reply to question 12, instances are frequently given of a tenacious memory for history or literature, accompanied by little ability for original thought. Such students are usually deficient in mathematical ability. One young girl learns a page easily, but she has to recite it in order, or all is a blank to her. Male, age 19. Recalled all that he heard or read, but his conversation and writings were masses of quotations.

On the one hand it is recognized that a rich mental life is impossible without a good memory; on the other, very complete association is often attended by poor constructive power.

The request made under heading 13 of the syllabus called forth a wealth of material. Certain cases due to abstraction are as follows: A young lady went to telegraph for an umbrella left on a car; she had been holding it over her head for 30 minutes. A lady walked into the parlor with a $10 bill in one hand, a match in the other. She put the bill in the stove and saved the match. A college professor forgets to eat his meals. A boy broke his ribs, and forgot all about it in two days. A man picked up a pebble and put it in his pocket; took out his watch and threw it into the ocean. A lady tried to tie her horse with the blanket and cover him with the line. A boy returned from the store three times to find out what his mother wanted. A lady was called away by an important message before breakfast, forgot until late in the day that she had eaten neither breakfast nor dinner. Gentleman, age 50, came down from his study and asked his wife if she knew where his pen was, he thought the children had mislaid it. She told him if he would take it out of his mouth he would talk more plainly. Boy, age 9, sent to store for extract of peppermint, brought paregoric; sent back with a bottle labelled peppermint, brought vanilla; third time sent he brought the peppermint. College professor, expert in numbers, is frequently seen with one black and one tan shoe on. A minister became absorbed in a book and forgot that it was Sunday. Man walked home and left his horse in the village all night. The same man went home from church and left his wife.

A great share of cases of lack of memory are due to abstraction, or to absent mindedness, which Mach terms "present mindedness." It often characterizes people of great ability along narrow lines of thought. The following is an instance of lack of memory due to fatigue: Female, age 22. "At the age of 16 I had been travelling all day, I went to the ticket

office at the last change of cars, but could not think where I was going, yet I had lived in the town 16 years.

There are a few instances given in which loss of memory is due to distraction. A middle aged woman heard of her son's death by drowning. She could not remember her husband's address in order to telegraph him, although she had written there hundreds of times. "Aunt recalls nothing that happens since her husband's death."

Defective memory in children is ascribed to things known. There are many instances reported in which forgetting occurred in the field of things done, many of these cases, however, are evidently cases of temporary forgetfulness due to abstraction. All of the Indians, with a single exception, state that things known are most easily forgotten. As to abstraction, no period of life is free from its influence. Not a few draw comfort from the facts frequently cited, that Samuel Johnson, when he had stepped from the sidewalk would continue for a long distance with one foot in the gutter and one on the walk; that Pestalozzi did not know enough to put up his umbrella when it rained; that Sir Isaac Newton supposed he had eaten when he saw the chicken bones on his plate; and that Edison forgot his wedding day. Still the fact remains that no period of life is free from noticeable abstraction. The boy with book in hand forgets to go to dinner after he has rung the bell; the young woman goes to different parts of the house, she knows not why; middle age hunts for the thimble on its finger, or the pen in its mouth; while old age is troubled that it cannot find the glasses on its nose.

Loss of mind and heredity are much less frequently cited as causes of forgetfulness than abstraction or distraction due to disease.

The fourteenth question was very abstract, and in some instances was evidently misunderstood. The answers came chiefly from young people. Of those who apparently answered in an intelligent manner 140 believed that the interval between being aware of an experience and the ability to define, locate and name the experience grows narrower as we grow old. Often the period up to middle age only is considered. One qualifies the statement "until old age;" two state that this is true until college is reached; while many consider that it holds until middle age. Not a few of the replies are the outgrowth of individual experiences, and would not apply after the age of 20 or 22 is reached. 125 state that the interval grows wider. Several state that this is especially true of middle age. The fact is recognized in the returns that the interests of middle life are greater, and the range of one's acquaintances is wider, and that this influences the interval necessary for recognizing and

defining an experience. This may not be the only factor, but it seems to offer, at least, a partial explanation. A fruitful field of inquiry is thus opened up and the ground broken. Prolonged and painstaking study of this problem may be richly repaid.

The writer acknowledges his indebtedness to President G. Stanley Hall for his unremitting interest and helpful suggestions, to Dr. E. C. Sanford for practical plans as to working up the returns, and to Dr. Burnham for criticism. He is deeply indebted to the many educators in colleges, normal schools, academies and high schools, for returns sent to the questionnaire. Their unselfish work remains as a most pleasing recollection. Mention must be made of Miss Lillie A. Williams, of the Trenton (N. J.), Normal School, for a great amount of excellent work; also of Miss Sarah W. Smith, of Medina, Ohio. A large number of papers were sent by President A. H. Heineman, of Haskell Institute, Ks., President Charles Meserve, of Raleigh, N. C., and by Booker T. Washington, of Tuskegee, Ala.

METHODS IN ANIMAL PSYCHOLOGY.

By LINUS W. KLINE, PH. D.

The differentiation of comparative psychology, as a branch and method to general psychology, has been comparatively slow. Its growth, however, has been natural and healthy, and its contributions to the study of mind are ever increasing in value. A complete historical account of this differentiation would be quite premature; yet it may be worth while to note in passing that several of the special problems of psychology,—for example: emotions, instinct, habit, heredity, etc., have been treated on very broad lines by such all-around scientists as La Marck, Brehm, Darwin, Kingsley, Wallace and Agassiz. A little later, men like Naegal, Huxley, Romaines, Lubbock, Graber, and Spalding, began to focus down and make experiments and observations on the senses, habits and intelligence of animals. Running somewhat parallel with these two groups of more purely scientific writers are the speculative and philosophic pens of Oken, Lewes, Spencer, Schneider, Weismann, Büchner, Cope and others who have evaluated and ennobled the facts of organic life by indicating their significance on the more serious and time-honored problems of mind and philosophy.

At present, definite problems, as the formation of association processess,[1] imitation, habit and instinct, are put to animals by playing upon some one or more fundamental instincts and taxic motions like those of hunger, sex, discomfort in solitude and prison, preferences for certain colors, geotaxis, chemotaxis, tonotaxis, etc. The ablest representative for psychology in this work is Lloyd Morgan, whose careful and critical interpretations of the objective manifestations of mind through bodily activities have done much to make comparative psychology reputable as a science, and even now essential to a comprehensive understanding of the more fundamental problems of mind. Wundt likewise has criticised to great advantage the usual erroneous and loose interpretations of animal activities. Criticisms of this type should not cease yet awhile.

The matter of interpretation at this stage, however, it seems to me is secondary. The most urgent need at present is more and better methods to get at the facts, which, when once discovered, will receive ample and proper attention.

[1]Thorndike, Edward L.: Animal Intelligence. An experimental study of the associative processes in animals. N. Y., June, 1898.

The systematic study of animals thus far has been conducted along two lines: oue, for a better name, we shall call the *natural method.* This consists in observing carefully and continuously the free life of an animal, for example: Huber, Moggridge, and McCook on ants, Audubon on birds, Figuier on insects, Mills[1] on our domestic animals; the second line of work may be termed the *experimental method.* Here the animal is subjected to certain conditions essential in putting a question, and that favor the performance of activities that shall contribute material for answering a problem.

Both methods are necessary to a more abundant ingathering of facts. Both are frequently used by the same investigators, *e. g.*, Lubbock and Bethe[2] on ants, and Morgan on birds. Both have their share of errors and abuses. In the natural methods the cleverness of animals is sometimes overestimated, anecdotes of a questionable foundation are given too much credence. In the experimental method, conditions too artificial are liable to be created, thereby inhibiting the free expression of the animal's acts. Fear is too often present, dominating and modifying every act. A recent investigation makes exclusive use of the second method, which seems to me exposes the results to serious criticism. I shall revert to this investigation later in this paper.

Partly as an illustration of the use of these two methods combined, partly to reinforce observations already made, and lastly to present a bit of new material, I present the results of experiments and observations made on vorticella, wasps, chicks and rats.

Vorticella Gracilis.[3]

The object here was to discover what activities, if any, have a psychological significance or value. The activities may be subsumbed under the following rubrics: Self-preservation, reproduction, and "miscellaneous." The first includes all those movements, whatever, both of the whole and parts of the cell, exerted in food-getting, ejecting detritus, placing the mouth in a more advantageous position for receiving food, contracting the stalk to escape an enemy, or when cilia touch any large body, dead or alive, etc.

The reproductive activities need no specification. Miscellaneous activities include all those movements for which we can

[1] Mills, Wesley: Animal Intelligence. 307 pp. The Macmillan Co., 1898.

[2] Bethe, Albrecht: Dür fur wirden Ameisen und Biemen psychische Qualit äten zuschreiben? Pflüger Archiv für Physiologie. Bd. LXX 1898.

[3] I am greatly indebted to Dr. C. F. Hodge for many valuable suggestions in carrying out this experiment.

assign no cause, *e. g.*, violent contraction of the stalk at a time when the field is free from any disturbing element that might be revealed by the microscope, food abundant, and body fairly well filled. Probably a study directed with a view to ascertain its chemotaxic and tonotaxic reactions would make some of these activities meaningful. I turn to the activities of self-preservation and note first the movements of the body as a whole. If the long axis of stalk and calyx is in and with a current of water,[1] the calyx is soon turned across the stream, forming an angle with the stalk. It is evident, owing to the well-known bell-shape of the calyx and the position of the cilia, that thus turning the bell would greatly facilitate food getting. Is there a psychical element in such a movement, *i. e.*, is the movement the outcome of the exercise of a psychical force? It appears to me that an affirmative answer is open to two serious objections: *First*, it can be explained in several other equally as plausible terms. The reaction to hunger alone is sufficient to account for the movement, and when we reflect that the habitat of V. is on grasses bathed by currents, natural selection might well be invoked as the principle that has impressed a reflex or mechanical movement of this sort on the cell. Then again, the inequality of the density of the current on the sides of the bell is a stimulus sufficient to cause a reaction expressed in movement (*tonotaxis*). Reactions of this sort occur in paramœcia,[2] hydra,[3] frog, and the human conjunctive; *second*, to ascribe a directing role to whatever psychoses that may be present in these forms to activities of this sort, precludes further investigation—just as the "fiat creation hypothesis" of the middle ages kept men from enquiring into the more rational ways of world growth.

The mouth cilia are so directed as to either receive or reject small particles of matter. These activities have been championed as psychical. That the cilia do these things there can be no question, but that they are movements directed by a psychosis, *i. e.*, are really selective, expressing choice, is quite another question. Before this question can be scientifically discussed, it seems to me another question must first be determined, viz.: Have vorticellæ a choice in food—do they not

[1] A current of sterilized water carrying yeast cells from a large flask was kept flowing under the cover slip. The water was drawn from the flask through a glass syphon, down to a capillary point, placed at one end of the cover slip, and a filter-paper drip attached to the other end. The microscope used was a Zeiss, apochromatic series, comp' ocular 12 objective 16 mm., which gave a magnification 190 diameters, and sometimes ocular 6, objective 4 mm. was used—magnification 375 diameters. The vorticellæ were found in great abundance from flags placed in an aquarium three weeks.

[2] Jennings, H. S.: Reaction of Ciliate Infusoria. *Journal of Physiology*, Vol. 21, 1897, pp. 258–321.

receive both digestible and indigestible material alike, and when filled eject both alike? It is a physical impossibility to receive even all the digestible material that comes their way. If given yeast they will receive 2, 3, or 4 grains at once and will then whirl the others away for 5, 10, sometimes 15 minutes before admitting any more. So that what has been interpreted as a selective process may be a reaction to "enough." To get facts that would answer the question one would have to first find a material[1] that they reject[2] altogether, then mix it with a palatable food, say yeast grains, and note their reactions toward the mixture.

I present in Table I the notes from my diary on a typical experiment with vorticella. It presents nothing essentially new or different from the work of Drs. Hodge and Aiken, save that yeast is a food for all the V. that I observed.

Again, do they discern between enemies and friends, between what is harmful and unharmful? If they do, we should expect to see the stalk contract in the presence of certain objects and remain extended in others or even remain in contact with them; and if they do not, we should expect the stalk to contract when the calyx comes in contact with any rigid, resisting, unmanageable object, organic or inorganic, dead or living matter. The latter condition is just what we do find. Vorticella takes no risks, trusts nothing, as it were, but contracts the stalk whenever the sensitive parts of the calyx or cilia meet with any resisting body whatsoever. I have observed the stalk contract when yeast cells and other food material came floating by in unmanageable quantities, or when the peristomal region came in contact with a large colony of bacteria—if the colony is small, they are hurled away by the cilia. I counted 118 stalk contractions due to the calyx hitting a dead leaf fibre. How long it had been reacting to this particular object, and how much longer it would have continued, had no accident intervened, can only be conjectured.

It seems to me all that we can say here is that the sense of touch mediates bigness, and persistence or rigidity, and reactions to such stimuli imply nothing more than simple mechanical reflexes.

Under the category of reproductive activities it is sometimes urged that the attachment of the free-swimming zoid near the base of the calyx is an expression of choice of selection on the part of the zoid, and therefore psychic. The zoospores of the cryptogamic world do equally as clever things in selecting

[1] This problem was suggested to me by Dr. Adolf Meyer.

[2] The substance would have to be partly insoluble, at least in water, and of low specific gravity. I suggest pepsin, lycopodium powder, a few of the salts of calcium and barium, ground glass and the like.

the right oospore in which to penetrate. My fondness for mysticism and the "brand-new" is too feeble to urge me to invade the botanist's realm searching for psychological material.

The presence of a psychoses is not denied. There may be feelings corresponding to the stimuli bigness, rigidity or persistence, whenever the organism mechanically responds to such. All that I affirm is that these activities give no indication that they are the outcome of the exercise of a psychical principle.

Table containing the observations on Vorticella gracilis.

EXPERIMENT 12.

Date and time.	Contraction of Stalk.	Remarks.
Nov. 22, 7.00 A. M.	None.	Cilia moving slowly. Vesicle closing about 3 per min.
" 7.45 "	None. Stalk well extended.	Feeding occasionally. Takes in yeast grains.
" 8.05 "	Regularly.	Stopped feeding.
" 8.45 "	Feeble.	A swift current bearing yeast grains has just started up. The long axis of stalk and bell are in line with current.
" 9.00 "	4 x per min.	
" 9.15 "	Less frequent.	Feeding again. Taken in two yeast grs.
" 9.25 "	None.	Takes in yeast grs. occasionally, permits the great majority to go by after being twirled rapidly by the cilia. It is a physical impossibility to take in all the yeast grains that come by, or, for that matter, other food material. The food revolves around a common center. The diameter of each revolution of any one revolving food mass grows shorter. The food thus approaches the center, but not quite, as it gradually works toward the mouth when nearing complete digestion.
" 9.45 "	Once, when a large torulae struck the body near the mouth parts.	Feeding slowly. Takes in 3 or 4 yeast grs. at once, then sets them to revolving with the great mass of food.
" 9.55 "	None.	Has turned the bell almost at right angles to the stream, (the stalk is in line with the stream). This offers a better position for taking food.
" 10.00 "	None.	Two yeast grains, after making one revolution, were hurled out not seriuosly injured.
" 10.10 "	None.	Ejected yeast detritus, *i. e.*, cells that had been digested to a shapeless mass.
" 10.30 "	None.	Followed two yeast grains through one revolution; time, 4 min. and 45 sec., about.

Table containing the observations of Vorticella gracilis.
(Continued.)

Date and time.	Contraction of Stalk.	Remarks.
Nov. 22, 10.35 "	None.	A torulae of six grains rest on the base of the bell. V. does not move—indifferent to their touch. Heretofore, when a similar bunch was caught about cilia and lip, contraction of stalk followed at once.
" 10.45 "	Once, violent.	Threw off the chain of torulae at base. It had supported the chain 15 min.
" 10.55 "	None.	Revolution of food not regular. Sometimes it moves by jerks.
" 11.03 "	None.	The body has been distended with yeast grs. for one hour.
" 11.30 "	None.	Yeast cells in all degrees of digestion.
" 11.55 A.M.	None.	Body growing shorter and thicker.
" 12 M.	Regularly.	Body has two mouths—a clearage line can be made out. At one edge of the field V. No. 2, that has likewise been under observation from the beginning, is also dividing. Differed from V. No. 1 only in feeding; has eaten less yeast, digested all.
" 12.15 P.M.	Rapid and violent.	Division complete with No. 2, making two bells attached to the same stalk.
" 12.20 "	Irregular but strong.	At close of clearage No. 2 daughters were roundish, dumpy, now becoming more bell shaped.
" 12 45 "	None.	No. 1 has completed divison. Neither No. 1 nor No. 2 have taken food for 45 min.
" 12.55 "	None.	No. 2 has begun to feed—taken in three yeast grains.
" 1.15 "	No. 2 violent and rapid.	No. 2 has lost her daughter. No. 1 eating yeast grains again.
" 2.00 "	Feeble.	No. 1 daughter bell detached. No. 1 throwing out digested material. Current has slowed up, yeast grains scarce.
" 2.15 "	Occasionally.	Cilia are developing about the base. Has stopped feeding, ejected most of detritus. Mouth cilia moving slowly and body elongating.
" 2.16 "	None.	Body rotating around stalk and quivering with violent action. Current nil.
" 2.18 "	Twice, violent.	Broken off from stalk and swimming away, having been under observation 7 hrs., 18 min.
" 2.30 "	None.	Current in region of No. 2 has run continuously.
" 2 40 "	None.	Feeding on yeast and other material that has somehow fallen into the current.
" 3.00 "	Occasionally.	Stuffed with yeast, body bent obliquely to the stream.

Table containing the observations of Vorticella gracilis.
(Concluded.)

Date and time.	Contraction of Stalk.	Remarks.
Nov.		
22, 3.15 "	None.	Yeast grains revolving—being digested.
" 3.45 "	None.	Ejecting detritus, taking in yeast grs. and other foods.
" 4.00 "	None.	Vesicle contracts about 3 x per min.
" 5.00 "	None.	For the last hour but little feeding, no yeast received, body filled with it.
" 5.10 "	None.	Food massed being churned, moved back and forth through the long axis of bell instead of revolving.
" 5.35 "	Once. Bell struck by a monster.	Filled like a balloon, takes in a yeast gr. occasionally. The great majority are made to pass on.
" 6.05 "	Feeble.	Food mass revolving again.
" 6.30 P.M.	Occasionally.	Body shortening and thickening.
" 6.45 "	Violent.	Second division has begun.
" 7.00 "	4 x per min.	Cleavage line distinct. Two mouths.
" 7.15 "	Few.	Division complete.
23, 7.30 A.M.		No. 2 still in the field—bacteria have developed during night to an alarming degree.
" 8.00 "	Every time cilia twirls bacteria or run into a mass too thick to be twirled.	Body well filled.
" 9.00 "	Violent.	Had stopped feeding for some time. Developed cilia and at 9 A. M. floated away. It had been under observation 26 hrs., 12 hrs. and 15 min. of which were constant.

WASPS. (*Polistes rubiginosus.*)

Sense of Smell.

The apparatus[1] consisted of a board 48 inches long and 15 inches wide, on which was built a glass hallway 18 inches long, 1½ inches wide and 1 inch high. One end of this long hall opened into two halls of similar dimensions, save their lengths, which was 9 inches. These short halls diverged from each other at an angle 70°. Both led into a single box, which was usually kept dark. These short halls I called "forks." The floor and top of the halls were glass. The odor was dropped on cotton batting the size of a pea. Odorous cotton was placed in the fork about 3 inches from the end of the long hall. At the same time the opposite fork contained a bit of odorless cot-

[1] For valuable help and suggestions in the construction of apparatus and experimentation, I desire to thank Mr. Willard S. Small.

ton—the object being to present as far as possible similar conditions to the eye. The apparatus was placed directly in front and about twelve feet from a window. The end containing the dark box was kept toward the window. The wasps used were a large, reddish, yellow-bodied, black-winged social species, *Polistes rubiginosus*, sent me from Virginia. While being introduced into the glass hall at the end away from the light, they were handled by broad and *very pliable* forceps. Gentle handling *must* be observed. At the close of each experiment the halls were thoroughly deodorized. This requires much time. The experiment should be performed on bright days, and in a temperature not below 60 F. The following odors were used: asafœtida, bergamot, carbolic acid, cinnamon, cologne, oil of cologne, cloves, pennyroyal, tar, turpentine, violet, sassafras, alcohol and spearmint. I have copied below three experiments from my notebook, the rest are presented in tabulated form.

ODOR: CARBOLIC ACID. NUMBER OF WASPS USED: FOUR.

Odor on the Right.

Wasp No. 1. Stopped about four inches in front of the forks—rubbed antennæ vigorously with fore leg for about 30 seconds, then took the left hand fork to the dark box.

Wasp No. 1. Stopped about six inches in front of the forks and after much hesitation and turning back and walking nearly the whole length of the hall, he went in on the left side.

Wasp No. 1. Walked straight down left fork without halting.

Wasp No. 2. Stopped about four inches in front of forks, then turned back. Approached again, crawled back and forth from fork to fork; at last crawled up to the top glass of the right fork and crawled into the box back down.

Wasp No. 2. Much excited—mad—crawled right over odorous cotton and went in box via right side.

Wasp No. 2. Approaches forks slowly, much brushing of antennæ; at last takes left fork to box.

Odor on the Left.

Wasp No. 1. Went in via left—crawled over the odorous cotton.

Wasp No. 1. Went in via left, hugged the sides of the wall while passing the odor.

Wasp No. 2. Went via right, after much hesitation at forks.

Wasp No. 2. Went via left, but avoided the odor by hugging the side of the wall.

Wasp No. 3. Went via right fork after halting one minute at the forks.

Wasp No. 3. Went via right; seemed much confused.

Wasp No. 3. Went via left after much hesitation and turning back and forth; hugged the under side of the top glass.

Wasp No. 4. Went via right; seemed pure chance.

Wasp No. 4. Went via right after much waving of antennæ and examining both roads.

Wasp No. 4. Stopped at forks, started down left, recoiled, and crawled back to the far end of the gallery; returns, stops at forks, cleans antennæ, then goes via right fork.

Summary.

Sixteen tests, thirteen of which showed conclusively that the odor was sensed, and eleven that it was objectionable.

Odor: Tar. Number of Wasps Used: Two.

Odor on the Right.

Wasp No. 1. Went via left fork; pure chance.
Wasp No. 1. Went via left; seemed not yet to have sensed it.
Wasp No. 1. Went via right; gave no attention to tar.
Wasp No. 2. Went via right fork; indifferent to tar. Cannot tell whether tar was even sensed.
Wasp No. 2 went in via right fork; came out of dark box into right fork, walked over the odorous cotton; seemed quite indifferent.

Odor: Absolute Alcohol. Number of Wasps Used: Four.

Odor on Right.

Wasp No. 1. Halted four minutes about three inches in front of odor, brushed antennæ vigorously, then crawled up the side of wall of right fork and passed into dark box.
Wasp No. 1. Went via left fork; this time seemed pure chance.
Wasp No. 1. Went via left fork, halted some time about two inches in front of odor, reared back, and finally took left fork to dark box.
Wasp No. 2. Turned down right fork, stopped about 2½ inches before odor, waved and stroked antennæ vigorously, reared back and plunged forward repeatedly, finally crawled in back down, on under side of top glass.
Wasp No. 2. Halted at forks, brushed antennæ, went in via left fork.

Odor on Left.

Wasp No. 3. Went in via left fork; avoided odor by hugging the side walls. Was mad and excited.
Wasp No. 3. Went via right; still mad.
Wasp No. 4. Walks slowly down gallery; stops at forks, waves antennæ and strokes them vigorously; then crawls up to the top glass and starts down the left fork; stops just before getting to odor, turns back and forth in much confusion; finally turned back and went via right fork.
Wasp No. 4. Went via right fork; did not halt anywhere on the road.
Wasp No. 3. Started down left fork, stopped in front of odor for some time, then turned back and forth repeatedly, finally crawled in via left fork, hugging side of the wall.
Wasp No. 3. Went via right, did not stop at forks.
Put 3 and 4 in long gallery together. No. 3 crawled down right side, did not halt at forks, kept straight ahead to dark box via right fork; and No. 4 stopped after entering the left fork, turned back and went via right fork.

Summary for Tar and Alcohol.

Tar may be sensed; it certainly is not objectionable. The twelve tests with alcohol show that it is sensed and that it is decidedly objectionable.

Unobjectionable.	Objectionable.	Doubtful.
Tar	Asafœtida	Cinnamon
Turpentine.	Bergamot	Violet
	Carbolic Acid	Sassafras
	Cologne[1]	
	Oil of Cologne	
	Cloves	
	Pennyroyal	
	Alcohol	
	Spearmint	

Conclusions. (1) wasps readily sense odors; (2) some are much more objectionable than others, *e. g.*, spearmint caused the most violent reactions. They moved up and down the galleries as if frightened or pursued by an enemy; (3) some odors, as tar, turpentine, are not disagreeable; (4) there is much evidence showing that the sense of smell fatigues—more observations, made with the greatest precautions, are needed to make this conclusive.

CHICKS.

I used chicks of two incubations of about five weeks apart. The first group were returned to their rightful parent at about the age of eighteen hours. To the second group I was foster parent fourteen days, and from their standpoint many days longer, for they often ran joyfully to me and followed me when I went among the farm poultry. They knew no other parent. Both groups, which were cross-breeds of Plymouth Rock, Leghorn, and Minorca, were taken from the hen eight to twelve hours before they had pecked through their shells, and kept awhile in warm water and then transferred to an incubator.

Group one, consisting of two little birds. At the age of four hours I placed them on a large newspaper spread on the floor. Their repeated efforts to stand erect invariably resulted in their toppling over sometimes forward, sometimes backward to a complete somersault. The tarso-metatarsus (featherless portion of the leg) does foot duty at this age, so that the distal end of the leg when standing is the tibio-tarsus. Walking is really running, darting forward from 16 to 30 inches and ending in a sprawl. After attempts to stand or walk, they take cat-naps.

These naps occur every few minutes, during which time the neck is stretched at full length on the floor and the head resting on one side. They nap most frequently in direct patches of sunlight. On awaking, clumsy attempts are made to smooth out the matted down—their only feathers—which had been un-

[1] It was thought that the objectionable element in cologne was the alcohol. The oil of cologne contains no alcohol, but they still avoided it, even though a very small drop was used.

kempt from the beginning. Only bright objects or strongly contrasted colored objects are noticed and pecked; large letters on the paper, bright threads in the carpet, at crawling flies, but with no success; bits of white pine, at their own and each other's toes, and at each other's bills, eyes and combs. At times they try to hover or cuddle under each other. I hold my hand over them under which they huddled close together. They act similarly toward almost any object held gently to their backs and heads—a stick of wood, a flannel rag, a shoe, a sock, a tin pan.

Age, six hours. Gave them crumbs of dough and bits of egg shells at which they frequently pecked but very seldom swallowed. They seized fairly well whatever they aimed at, but seemed to have trouble in holding it and getting it adjusted for deglutition. They follow, although their pursuit is interrupted by frequent falls, any comparatively large moving object: a hat, a folded garment, a tin pan, the cat, a person. I walk by one piping the want note, which by the way is their earliest and most frequent note, to a doorway ten feet distant, pass through the doorway over a sill ten inches wide inclined at an angle of fifteen degrees, the lower edge one and one-half inches high, into the next room and step behind the door. The chick makes the door sill in two runs, and to my surprise gets upon and over the inclined door sill and enters the room to a distance of eight or ten feet, looking and piping to the fullest capacity of its voice. Finally it takes a nap.

Age, eight hours. One swallows a dead fly after mangling it. I clap my hands close to their heads, make a loud hissing noise, they take no notice of either noise. I thrum on a guitar; this startles them, but they settle down so soon as the noise ceases and sleep, especially if the thrumming lasts from 30 to 45 seconds. Later they chirp the want note vehemently. I sneeze—they stop chirping for some seconds. Striking a pan has the same effect.

Group two consists of four chicks. Chicks Nos. 1 and 2 born August 28, 4 P. M., No. 3 August 29, 11 A. M., and No. 4 at 3 P. M.

17 hours old. August 29, 9 A. M. Nos. 1 and 2 now 17 hours old are placed in their poultry yard, 4 ft. wide, 5 ft. long and 2 ft. high—built in an attic with southern exposure. I give them cracked wheat, bits of half matured maize. They peck at the larger pieces of food and succeed in getting them into their mouths, but allow them to fall out. At last No. 2, the larger and brighter of the two, after making three trials to swallow a half a grain of wheat succeeds in the fourth attempt. They do not confine their attention long—15 seconds to about 30 seconds—to the different foods, in fact they are more con-

cerned about the objects in their new quarters. Everything attracts them with about equal force. They have had no experience from which to form preferences. (*17 to 18 hours old.*) Accordingly all objects within reach must be examined—the large letters and figures of the newspaper, the cracks in the floor, the wood work of their yard. They follow moving objects occasionally. The walking mechanism is fairly co-ordinated and under control. They never topple over backwards, and rarely tumble while moving forward. Loud and sudden noises shock them—not quite fright, for they never try to escape. Banging on a tin pan, thrumming a guitar, tooting a horn, clapping the hands, causes them to start, squat and shudder.

2 P. M. No. 2, 22 hours old, catches and swallows a wingless fly. I drop an earth worm (*Lumbricus*) before them. No. 1 looks at its serpentine movements, steps back skittishly, and gives for the first time the well known danger churr, approaches the worm, pecks it, wipes his bill, pecks again and then lets it alone. I give them two more worms. No. 2 spies and approaches one, strikes it twice, wipes his bill, and lets them alone. Their bills are yet too weak to seize earth worms.

4 p. m., chicks one day old. I heard an unusual piping in my poultry yard. No. 2 had jumped out of the warm box—a feat five inches up and a fall fourteen inches—into the yard. He is now the sole occupant. When I approach he scurries behind the box and crowds close up in the corner of the yard. This is the first time that he seems afraid of me, or has shown signs of genuine fear. I drop earth worms in the yard a second time, both show signs of fright and do not even peck at them.

No. 3, born 11 A. M. Placed it on a newspaper at 3 P. M. Its efforts to stand, walk and swallow, closely parallel those of 1 and 2. It made three attempts to follow me, and one to overtake an old garment folded up and dragged slowly by it. I did not permit it to overtake the garment. Later drew it by several times, but it took no further notice of this garment. It sleeps when not molested.

No. 4 or "the lonely chick," born August 29, 3 P. M. This chick is completely isolated from all others of its kind for four days less eight hours. His food is confined to bits of half matured maize and occasionally cracked wheat and water. Of course he gains a knowledge of the food qualities through experience by pecking at the several objects of his prison, *e. g.*, specks in the carpet, nail heads, rollers of table, large letters in the newspaper, etc.

Second day. August 30, 7 A. M. No. 2, as before, has jumped out of his box and shows signs of fear at my approach,

but when I hold out my hand he runs to it and eagerly surveys it. Yesterday he avoided his excrement after four experiences pecking at it. This morning he shows evident signs of disgust at the first trial.

9 A. M. I place a tin of water on the floor. All three run up and peck the brighter portions of the vessel while walking around it. I trouble the water gently by rocking the vessel. No. 2 sees the ripples, stretches his neck to examine, at the same time stepping back and uttering the danger churr. This is not at the motion of the tin, for they have been accustomed to this all along. When the surface of the water quiets, No. 2 approaches and begins pecking at shiny places as before. In doing this he throws a bit of cracked wheat lying on his head into the water, he seizes and swallows it as usual and smacks his bill, as if tasting, then thrusts it into the water up to his eyes, turning his head up he drank after the characteristic chick fashion. This was an entirely new movement, for bill, head and neck. It was executed to perfection. He dips his bill in twice more and as deep as before. This seems unpleasant, for he walks away hurriedly each time and wipes and scratches his bill. A bit of spider web thoroughly filled with wood dust bored out by a bee fell into the yard. No. 2 pecked at it six times. It gives him no satisfaction. He let it alone. Nos. 1 and 3 then give their attention to it. They soon desert it.

10.30 A. M. Offer them water a second time. No. 1 discovers it for himself somewhat as No. 2, *i. e.*, by pecking at a speck on its surface. Both 1 and 2 now drink together. No. 3 steps up and watches the motions of No. 1 in a single act of drinking. He immediately begins to drink. No. 2 has learned to thrust his bill in at the ordinary depth. I offer them an earth worm for the third time, this time as food, in my hand. All come up and look in. No. 2, who leads in everything, sees it crawling, gives the danger note, at this the others look more intently, then all walk away. They fear more things with age. Sounds that yesterday were unheeded are to-day listened to with surprise and fear. They shy away short distances whenever I approach. My hand, to which they have become accustomed, brings them back. Evidently they have not become acquainted with my body as a whole.

4.30 P. M. I give them bits of yellow pine in one portion of their yard and cracked grains of yellow maize in another. The morsels of food look not unlike. They eat the maize as usual. No. 2 seizes a bit of pine, fumbles it in his mouth, drops it, tries another, drops it likewise, and pays no further attention to the wood. No. 3 tries three different pieces before swal-

lowing one. He swallowed two bits, then turned to the heap of maize.

5.30 P. M. I gave them bits of starched muslin cut about 1 mm. square from old collars and cuffs. All three attack the little pile eagerly. No. 1 swallowed a piece; No. 3 ran off with quite a large piece; the others gave chase. This heightened, apparently, the desire of each to secure it. They snatch it from each other's mouths until No. 3 despatches it. They return to the muslin, look at it, pick up pieces lightly and drop them. Their appetites for muslin soon quail. It was the last that I persuaded them to eat. Competition even at two days old spurs them on to more prodigious tasks. No. 2 has tried repeatedly to swallow a whole grain of maize, but without success. No. 1 attempts to snatch it away. The grain passes back and forth from mouth to mouth, while chasing each other around the yard, until finally No. 2, although hard pressed, makes an unusual effort to swallow it and succeeds.

4 P. M. No. 4, the chick in solitude now one day old, is offered a tin of water. Gives it no attention. Drop food near the sides of the vessel, and later a few bits in the water. It seizes the food on the water, thereby getting water in its mouth. The stimulus touches off the drinking apparatus, for it at once goes through the drinking movements. But the water seems to frighten it very much. It runs off some distance; wipes its bill repeatedly. I coax in vain for it to return to the tin of water.

Third day. August 31, 9.15 A. M. I give Nos. 1, 2 and 3 green cabbage worms for the second time. No. 2, as usual, gave danger churr, all walk away. They still fear earth worms. Nos. 1 and 3 contend over a bit of muslin, but soon neglect it. I threw them several bits of muslin—all came up and looked at it and then walked away. They treat pine wood similarly. Show joy when I sprinkle wheat and Indian meal on the floor by running up and flapping their wings. They devote more time to preening their feathers and stretching in the sun. I thrum the guitar as on first day. No. 2 scurries away behind the warm box, and 3 runs and squats as if hiding. I wave the guitar over the yard once. No. 1 runs screaming to the farthest corner and tucks his head under the edge of the paper that forms the wall to their yard. A wasp flies against the window, No. 2 gives the danger sign, the rest listen. A sailing cloud throws a rapidly moving shadow across their home, it frightens them very much.

10 A. M. No. 4, now nearly two days old, is again offered water. It looked in the vessel then walks away, did this three times.

September 1, 8 A. M. Nos. 1, 2 and 3 still avoid earth

worms, caterpillars and green canker worms. They learned to drink milk yesterday in much the same way as they did water. They show no sign to-day of having seen it before. They approach it cautiously, peck around the edges of the tin for six minutes, and after much stretching and craning of their necks in looking at the milk, begin to drink it. Their experience with the white boring grub is interesting. Nos. 1 and 2 are afraid of it, No. 3 seizes the grub while curled up, looking not unlike a grain of corn. No. 1 gives chase, and, as usual, the desire for the worm is increased until No. 3 swallows it. I give them three more grubs. The grubs begin crawling, and so long as this is kept up the chicks give the usual danger note and crane their necks forward in fear and wonder. The smallest of the grubs stops crawling, No. 3 seizes and swallows it at once. This, I judge, encouraged him to try the second largest. No. 2, by imitation, seized the largest grub, which I had considered too large for them to swallow. The others endeavored to share so large a morsel with No. 2. This precipitated quite a tussle, which ceased by the lucky one despatching the grub.

12 M. I take Nos. 1, 2 and 3 on an outing, as it were, of one hour and forty-five minutes, into a large grass plot. While here their behavior, more than ever, impresses me of the great importance that experience plays in their acquaintance with the chicken world. They were unusually active the entire time, pecking at the different grasses, seeds, sticks, dried leaves, bees, crawling ants. The bright husks of the pepper weed and the seeds of the short wire grass received their first attention because of their brightness. I concealed two black watermelon seeds under a tuft of grass, farther on a yellow seed, and in a third place the seeds of a cantaloupe. They discovered all three in due time—each discovery was attended with notes of surprise, and the investigation set out with cautious pecking. It seems that their nerves are keyed for responses to every stimuli of sight and sound, that their organism is essentially nervous, responding and adjusting to a novel environment. No. 3 spied an earth worm coming out of the ground. He seized it at once, and pulled and tugged at it not unlike robin red-breast in a similar feat. This was the first earth worm eaten. No. 4 (the lonely chick) is not thriving like his congeners. His body is becoming short and rounded, "dumpy;" the head is drawn in close to the body. When not eating he pipes the lonely want note. His efforts to make friends with a half-grown cat was an amusing performance. Its first advances were met by gentle soft taps from the kitten, for which attention it chirped the satisfied note, and made repeated attempts to cuddle up in the kitten's fur. This appeared to annoy her felineship. She began moving backwards on three

feet, using a fore foot to bar the chick's too familiar advances. Her pats finally grew to taps, then to slaps, and at last to a severe box that sent the chick rolling over several times. This experience destroyed the chick's desire for further affiliation with the cat. Nos. 1, 2 and 3 after eating a full meal spend much time in making their toilet, basking in the sunshine and engaging in mock fights. These and other activities essentially chick-like, are the fullest and most varied after a sumptuous meal.

Fourth day. September 2d. They still show signs of fear when I drop a small earth worm before them. But this time No. 3 seizes one before it begins crawling. This whets the appetites of the others. I divert the pursuer's attention by dropping another worm, it is seized and carried to one corner to be devoured. They now seize small *moving* worms, but large *crawling* ones overtax their courage. They are now indifferent toward green cabbage worms, do not even show signs of fear in their presence. White grubs are attacked and eaten, if not crawling; the crawling grub presents a sight too hideous for them, even at the age of four days.

No. 4—the lonely chick—now nearing the age of four days, is brought from his isolated quarters to my poultry yard. He presents a dumpy, ill-conditioned form and a fretful, timorous attitude, yet always ready to eat. The three approach and station themselves in a semi-circle about the stranger. Nos. 1 and 2 give the astonish or surprise chuckle. All three stretch their necks and peer scrutinizingly at the intruder as if "to look[1] him out" of their presence. No. 1 advances and strikes him a severe blow on the head. He attempts to return it, but is struck again and seized by the head and pulled and jerked about in battle royal fashion. At this treatment he screams the shrill cry of distress and tries to escape from the yard. He is nagged for some minutes, and finally permitted to stand in one corner and utter those lonely piteous cries that he has been making ever since he began to walk.

I now distribute several kinds of food in distant parts of their yard, thereby increasing the unwelcome stranger's opportunities for getting his breakfast. He makes good use of the advantage, and snatches a morsel now here, now there. Although he is occasionally struck at, it is apparent that his presence is becoming more tolerable, and in time will be suffered to remain in peace. And so he was at the expiration of two hours with all four basking together in a parallelogram of sunshine. They lie on one side, stretch the free leg and

[1]The reader will understand this phrase as merely descriptive of their appearance and nothing more.

wing at full length. So well at ease had No. 4 become that while thus stretched out on the floor, he raised the free expanded wing and fanned it gently back and forth showing every sign of comfort. This is the first time he has shown genuine contentment. It took companionship to make his life complete. I gave them grubs and earth worms, which were eagerly devoured, after which I offered them green cabbage worms. This was No. 4's first experience with worms of any sort. He had just witnessed the others eat grubs and earth worms with impunity. So when the green cabbage worms appeared, he did not hesitate to devour them while the others stood back or walked away. But his spirited and ravenous dealing with the worms induced the others to rob him of a worm—a lively chase ensues which ends in the competitors devouring fragments of the worm.

The only activity during their outing to-day (ages four and five days) that deserves notice is that of wallowing on the hard ground and shuffling the wings after the manner of full feathered birds when taking a sand bath. The motion of the wing, when sand is present, both gathers and throws the sand over the entire body not unlike a shower bath. The movement appears complex.

Fifth day. September 3, 7 A. M. Cabbage worms are offered No. 4 the second time. Nos. 1, 2 and 3 stand aloof. No. 4 eats one, wipes his bill vigorously several times, returns to the squirming heap, shakes his head. He never ate cabbage worms after that. My chicks have a peculiar way of shaking or slinging the head—as if in disgust, at the sight of an object disagreeable to their taste. Again during their outing they indulge in attempts to wallow on the hard ground. They made a similar attempt on the floor. They now appear to know their "outing grounds." So soon as placed on the ground they run and dart hither and thither and flap their wings, and engage in mock fights.[1] This usually begins by a sudden and simultaneous darting about and clapping the wings, and then rushing together giving each other light pecks. They are less timid, pay less attention to the various noises and sights about them, and wander farther away from me and from each other. When these little excursions isolate them the lost note is piped. They always find their way back. To-day for the first time they give evidence of wishing to perch in high places. No. 1, after walking around a basket, five inches high, several times and looking at its top, mounts to its rim, and as soon as he has balanced himself sits down. Later at roosting time he tries to

[1] See Wundt, pp. 357-8, and Karl Groos: The Play of Animals. D. Appleton Co., N. Y., 1898.

fly to a horizontal stick four inches high, forming a part of the yard's frame-work. He also flies up the side of the paper wall and pipes the distress note when he wants to go to roost. He invariably chooses the same corner of the wall over which he attempts to make his escape, and although he mounts only a very small fraction of the wall, his efforts never tire in covering that small distance. I offer them again bits of muslin and pine wood, which they have not seen for three days. The muslin is ignored, several pieces of pine are picked up and dropped by each one. No. 2 finally swallows a piece—the fifth that he had examined. He walks away and wipes his bill. Four days later I offer them pine wood. It received no attention this time even though I continued to sprinkle it before them as I do grain.

Sixth day. September 4th. After eating their breakfast, wallowing in fresh, loose ground and preening feathers, Nos. 2 and 4 engage in a mock fight. No. 4 sits on the bottom rung of a ladder, the top of which rests on the top of the yard enclosure, thus affording an outlet, should they make an effort to use it. This occurred at 8 A. M. At 8.45 No. 3 walks halfway up the ladder and sits down. No. 4 attempts to fly up to No. 3, but fails. No. 3 gets up and continues his way up the ladder; at a height of 18 inches he stops, looks about, both feet and wings tremble and quiver. Steadying himself, he turns around and descends the ladder to a height of 10 inches, sits down and completes his toilet in apparent ease. They now seize earthworms whether moving or crawling.

An instinctive movement was made by No. 2 at the close of his toilet exercise, that is both comical and instructive. After smoothing out the pin feathers of his breast and straightening out the sprouting remiges, he stretched up at full height, flapped his wings against his sides in approved gallinaceous style, and at the close of the wing movements swished and wiggled the little bunch of cottony pin feathers that occupy the place of the future tail feathers—a beautiful illustration of complete development and co-ordination of both nervous and muscular apparatus long before there is any need of their functioning; for the tail feathers over which these nerves and muscles have control did not show themselves until three weeks later.

Seventh day. September 5th. I notice that they are quite sensitive to changes of temperature. No. 1 stepped on a motionless earth worm. The foot was taken off with a sudden jerk. It had not noticed the worm. I laid a cold copper wire down, one stepped on it and immediately jerked the foot up. Their room has a southeast exposure. The first rays of the sun fall on the right wall of their yard about one foot from the floor. They spend much time in looking at the bright spot.

It descends obliquely to the floor, reaching it in about twenty minutes. They have now learned to stand ready waiting for the warm rays to fall on them. These September mornings are chilly. The direct sunlight reaches the left side of the yard by noon. They follow it up as it crosses the yard whenever they make their toilet or wish to cat-nap.

8.30 A. M. No. 3 mounts the ladder and climbs the rungs quite a distance, sits down at a height of 11 inches. Nos. 2 and 4 stand under him, stretching and peering their heads up, and try to fly up. It did not occur to them to walk to the lower end of the ladder and walk up. This is the third time that No. 3 has perched on the ladder, and every time 2 and 4 have tried to reach him by flight, standing directly under, notwithstanding too, that both have seen No. 3 begin his ascent at the end of the ladder.

5 P. M. No. 4 for the first time walks to the top of the ladder. This gave him a view of the world outside the poultry yard. He looked intently in several directions and at times uttered notes of surprise and the "wonder chuckle." He walked a short distance from the end of the ladder out on the top of the wall of the yard. He looked first on the outside, then on the inside, as if in doubt which way to fly. He finally flew down in his old yard. No. 1 for the past three days grows very restless at the approach of night and tries to escape as before described. He walks around the four sides of the yard; on reaching the fourth corner he attempts to fly oyer. He is as persistent in his efforts as a bee against a window pane. He has ample opportunities for learning to use the ladder, but pays no attention to it when he wishes to escape. All have taken a turn in walking up the ladder, save No. 2, who is very large for his age, with wings undeveloped. He never shows discontent. His fellows have small bodies but rapidly growing wings. They grow restless. No. 4 has made two more excursions to the top of the ladder. An outside ladder butts against the inside one at the top of the yard wall. No. 4 stepped on this ladder, walked down two rungs, uttered a cry of fear, stepped off backwards on to the inside one and walked down into the yard.

Eighth day. September 6th, 6.45 A. M. Gave them green canker (cabbage) worms. They gave the surprise chuckle, finally No. 4 seized one, then all gave chase until he swallowed it. All return to the worms, but refuse to take hold. They begin to clamor for food.

7.30 A. M. They have had a sumptuous breakfast. Preening feathers, mock fights and the like follow. No. 4 has walked to the top of the ladder four times since breakfast. He has stepped on the outside ladder twice. The others still watch

him as if they too would like to climb up. During the forenoon he climbed the ladder fourteen times. Sometimes he would step on to the outside ladder but never ventured to walk down. After his noon meal he walked up the ladder and out on the top of the poultry yard fence. He walked back and forth leisurely on the wall and while attempting to catch a passing fly he slipped off and dropped on the outside. He showed signs at once of desiring to return to the yard. He walked around and under the outside ladder. It was made exactly like the inside ladder and leaned against the wall at the same angle, but it never occurred to him to use it. During the space of an hour he walked back and forth along the wall thirty-two times, and put his head through a small crack, looking into the yard, thirty-eight times. Toward the end of the hour he became more reconciled to his lot and began to search for food.

Ninth day. For some time they have been pulling off bits of paper forming the wall to their yard to get the flour paste used in their wall paper. To-day they pecked and pulled at a piece that turned in until they made an opening large enough through which to escape. They walked out. I put them back. They went at once to work and pulled it in and up. Out they went again. This was repeated until I fixed it securely. I kept them in their poultry yard until the age of fourteen days. They never learned to use the two ladders as a means of egress and ingress, although I frequently put them through the movements of climbing one ladder and descending the other.[1]

Conclusions.

1. Both hearing and sight are dull during the greater part of the first day. They develop very rapidly the second and third day, being highly sensitive on the third to any and all sounds and noises.

2. Pecking is better developed from the first than swallowing, in fact the muscles for holding the head erect, for controlling the jaws, and the process of deglutition are very weak the first 8 or 10 hours.

3. Fear increases with the development of sight and sound.

4. The instinct to follow soon fades out. Hovering and cuddling together are instinctive. Both Morgan and Mills seem to think that hovering under the hand or following it is due to the warmth it affords them. I find they follow any small moving object at first. Later the hand becomes a very interesting object; their attachment grows out of its being their only source of food.

[1] To expect them to learn a task by forcing them through it, has impressed me since as a very artificial if not an actually absurd thing to do.

5. Mock fights begin the third day, and shade over into serious business the sixth week.

Wundt[1] regards mock fighting as the only type of play among animals, and interprets it along with Karl Groos[2] as a schooling to the serious struggles of adult life.

The different degrees of permanency of their associations suggest a problem for extended work among several species. They rejected pine wood after a few experiences at the age of three days, but three days later they ate it again, while experiences with muslin on the third day was lasting. They were six days getting acquainted with earth worms, and eight days with the canker worms.

They learn to do some things by imitation, *e. g.*, drinking, learning to eat certain foods, escaping from their enclosure, while other tasks of apparent equal simplicity are not learned. Though the fortunate one performs the trick before them every day. No. 2 learned to escape from the "warm box" at one day old, the others, more agile in most things, never learned the trick. I quit putting them into the box the fifth day. Dr. Thorndike[3] inclines strongly to the belief that domestic animals do not imitate each others performances. This belief is founded on the results from experiments conducted exclusively on what I have called the *experimental method.* Describing his method he says: "It was merely to put animals when *hungry* in *enclosures* from which they could escape by some simple act, such as pulling at a loop of cord, pressing a lever, or stepping on a platform." The motives, then, played upon were hunger, desire for freedom, and surely in many cases fear—especially would this likely to be true with the young brought into novel situations. Imitative activities form a good part of play activities—not all play is imitation, nor *vice versa*, but much of the two are on common grounds, and find their fullest expression under similar conditions. What are these conditions? Just the opposite to those created in his experiments, viz., freedom, security from harm, satiety, in a word—well being. Nothing so shrinks and inhibits completely the fullness and variety of an organism's activities[4] than prison[5] life[6] and fear.[7] Dr. Thorndike first teaches a chick to escape from a certain situation, then places along side of this one that "knows the ropes"

[1] Wundt: Human and Animal Psychology, p. 358.
[2] Groos, Karl: The Play of Animals. Translated edition, 1898.
[3] Thorndike, Edward L.: *Loc. cit.*, p. 6.
[4] Verworn, M.: Pflüg. Archiv., Vol. L, 1891, pp. 439-440.
[5] Cornish, C. J.: Animals at Work and Play, pp. 31-38, 1896.
[6] Jordan: Habits and Developments of Newts. Jour. Morphology, Vol. VIII, pp. 269-366.
[7] Kline, L. W.: *Am. Jour. Psy.*, Vol. X, No. 1, 1898.

others entirely ignorant, and says by his experiment "imitation if present will surely come forth." To get a particular tone from a musical instrument we must play on certain definite keys. Dr. Thorndike has played the wrong keys. It seems to me all that we can say at present is that some individuals of a species learn some things by imitation. I heartily agree with Professor Mills who finds wide individual aptitudes among members of the same brood, or family.

White Rat.

The object of the experiment with the white rat was to ascertain its susceptibility to profit by experience, to test its quickness to learn by appealing to its most dominant and characteristic activity in food getting, the readiness with which contiguous associations are built up.

For this purpose stimuli was addressed to the rats' pawing and digging[1] activity by means of the following device: (1) A box 8 inches long, 7 inches wide, 6 inches deep, whose sides were of wire, top of glass and bottom of wood, was put into their home box, which also served for an observation box. At one end of the floor of the small box a piece 3½ inches long and 2 inches wide was sawed out. The box was raised above the level of the floor by resting on two strips 1½ inches thick; (2) sand and sawdust was heaped up loosely around the sides of the box until it rose a little above the level of its floor; (3) food (dog biscuit and cheese) was put in the box.

The observation box, containing two rats, was 18 inches long, 14 inches wide and 14 inches deep, one side was wire, one end glass, the rest of wood. The rats knew practically no other home, they had been reared in much the same sort of box. Before beginning the experiment I left the experiment box in their home several days, so that they had become quite familiar with it. Their exceeding timidity makes such precautions necessary.

Experiment I. January 9th, 2 P. M. Both rats at once attacked the box, crawled up the sides, over the top, and went round and round in a very monotonous fashion—always smelling. They persevered nearly an hour. At 3 P. M. their movements were less decided, seemed more haphazard and indifferent. One gave up and returned to the nest,—the second, somewhat more frisky, began scratching the sawdust in that very instinctive fashion which I have observed them do under

[1] I am not yet satisfied that I have appealed to its dominant trait or method of food getting. On *a priori* grounds I had thought that the gnawing activity was the best developed—a tentative experiment threw doubt on this and suggested the one used.

all sorts of conditions, even when they are well fed. It appears to be a "wild trait in a tame animal," as Robinson[1] has characterized such more or less useless instinctive performances among our domestic animals.

The hole thus accidentally dug happened to be at the end of the box where the piece had been taken out of the floor. The rat immediately poked its nose into the new opening which was not large enough to admit its head. It seemed to be frightened, ran to its hiding place, came out after about a minute, smelled cautiously about the hole, and dug away more material, then scampered away as before. These acts were repeated several times, until an opening quite too large had been made. It then ventured cautiously up into the box, snatched the food and carried it to its hiding place at 3.30 P. M., after working one hour and thirty minutes.

Experiment II. January 10th, 3.45 P. M. They behaved to-day much like the preceding, *i. e.*, climbing up the sides, walking over the top, except that they spent more time about the place where they had excavated the day before—seemed to have located the place in an indefinite sort of fashion. They frisked and fidgeted about 4 minutes, then one began digging with a will, and did not stop this time until the work was complete. But, as before, they hesitated to enter at once into the hole and box, they frisked nervously about for some time—coming up, peeping into the hole, then scampering off. At 3.53 P. M., or after eight minutes' work, one ventured in after the food.

Experiment III. January 11th. Set experiment agoing at 2.12 P. M. One came out of nest about a half-minute before the second. They did not climb up the sides and over the top of the box, but confined their movements about the place where they had made the burrow the two preceding days. After smelling around 1½ minutes, No. 1 went to work and in a half minute a hole of sufficient size was made. This time there was no hesitation; it went right in. Snatched the food at 2.14 P. M. Time in getting food 2½ minutes.

Experiment IV. January 12th. Experiment began 4.17 P. M. Rats came out immediately, climbed up side of box, then on to top, walked about sniffing the air, crawled down, and went at once to the usual digging place. At 4.20 it took food out. Time, 3 minutes.

Experiment V. January 13th, 4.15 P. M. Rat No. 1, only, came out. Approached the box leisurely, sniffed the air quite often. Stood erect, with forepaws against the box. Suddenly,

[1] Robinson, Lewis: Wild Traits in Tame Animals, 326 pages. Edinburgh and London, 1898.

as though the idea had just possessed it, it got down and began the usual excavation. Stopped when half done, walked away, came back, finished the opening, and took food at 4.18½ P. M. Time, 3½ minutes. The indifference manifested in this experiment I think is due to their being too well fed. No. 2 did not even leave his nest until No. 1 had started home with his food. It is evident that they have learned how to get their food (during the experiment it was given in no other way), and that they must have greatly profited by their *first* experience—the first attempt to reach the food required 1 hr., 30 min.; the second attempt, 24 hours later, only 8 minutes. I am not persuaded, however, that the elements in the associative chain, whatever the psychologist may decide their nature and number to be, have as yet taken on any very stable and clear form. They seldom begin digging at the proper place, sometimes will begin holes in several different places, and they will not dig at all until they have made several examinations of the box. All these preliminary activities may fade out in time.[1]

The methods presented here enable us in a comparatively short time to point out more distinctly, and that, too, in an elementary way, the dividing lines between instinct,[2] intelligence, and habit, *e. g.*, it was instinct that prompted my chicks to perch, or my rats to scratch up the sawdust; it was intelligence gained through chance experience, that enabled the chicks to escape from the yard, and the rats to get food from the box; it was habit that made the chicks go in a particular roosting box, unsolicited, at the approach of night, while they were wholly indifferent to another box and would escape from it if put in it.

To Dr. Edmund C. Sanford I desire to express my best thanks, not only for suggesting the work itself, but for valuable help and timely suggestions at every turn during its execution.

[1] I have since performed 8 more experiments. The time has been reduced to 30 seconds, and many of the useless preliminary performances have been dropped.

[2] Morgan C. Lloyd: Habit and Instinct.

MINOR STUDIES FROM THE PSYCHOLOGICAL LABORATORY OF CLARK UNIVERSITY.

COMMUNICATED BY EDMUND C. SANFORD.

XII. ON NEARLY SIMULTANEOUS CLICKS AND FLASHES.

BY GUY MONTROSE WHIPPLE, A. B.

Judgments of the time order of nearly simultaneous clicks and flashes have been studied by several investigators, but with discordant results. Exner[1] and Gonnesiat[2] find that the order click-flash can be recognized when the interval of time between the two stimuli is less than when the order is flash-click. Bloch,[3] Tracy[4] and Miss Hamlin,[5] on the contrary, find that the order flash-click is the more easily recognized.

In explanation of this difference Miss Hamlin suggests, on the basis of her own and Tracy's work, that it "depends on the fact that series of pairs of stimuli were used in one case [Exner's] and single pairs in the other. In his experiments on personal equation Gonnesiat finds rhythm a very important factor, and it may have been effective in these experiments of Exner's." The present study has chiefly in view a comparison of the 'series' and 'single pair' methods when judged by the same subjects.

Apparatus and Method. The apparatus consisted of an arrangement for producing the clicks and flashes, and of a double set of switches, one of which could be used to cut out single pairs of stimuli for observation, when single pairs were under investigation, while the other served to reverse the order from click-flash to flash-click without altering the other parts of the apparatus. The arrangement for producing the clicks and flashes consisted of a double revolving disk of special construction, so arranged as to make contact for an instant in two in-

[1] *Pflüger's Archiv*, XI, 1875, 403-432.
[2] *Récherches sur l'equation personnelle*. Paris, 1892, pp. 138-140.
[3] *Revue scientifique*, XXXIX, 585.
[4] *American Journal of Psychology*, V, 567 f.
[5] *Ibid.*, V, 564-575.

dependent electrical circuits.[1] One of the disks was fixed permanently upon the shaft of the instrument, and was divided into degrees; the other could be turned upon the shaft so as to alter the separation of the contact points (of which each disk carried one), and was provided with a vernier, by means of which the setting of the disks with relation to each other could be read to one-tenth of a degree. These disks were driven at the required speed by a small electric motor, the speed of the motor being properly reduced by the interposition of gears and pulleys. The actual clicks were given by a telephone, and the flashes by a Geissler tube and induction coil, both controlled by the instrument just described. The tube was encased in a blackened box, but seen directly through a horizontal slit 115 mm. long by 6 mm. wide. The room was partially darkened during experimentation.

It is hardly to be expected that an apparatus driven in such a manner by an electric motor should be wholly constant in rate. Careful timing showed a difference in rate of about 0.1 sec. per revolution,—from 899σ to 796σ,—during a five minutes' run of the apparatus. This, however, is less important in the present instance than the irregularity from revolution to revolution, which was such as to give a maximal mean variation of 10.9σ in an average of eight determinations taken at random from the records of a single minute. This variation is larger than could be wished, but as the contact points of the two disks were never more than 27° apart, it involves a variation of only 0.8σ in the time values of interest for this study. This variation makes the measurements rough, but leaves them of sufficient accuracy, it is believed, for the questions to be determined.

The time for any set of tests was found by calculation from the setting of the disks and the time for 100 revolutions of the disks taken with a stop-watch giving fifths of a second.

The rates at which the pairs of stimuli recurred when they were used in series were approximately: one-half, one, two, three and four seconds. Ten consecutive pairs were included in each series. When single pairs were used the intervals from test to test were taken at the operator's convenience.

The method of right and wrong cases was employed, the subjects being given an equal number of click-flash and flash-click orders irregularly mixed, and being required to register

[1] While the instrument was arranged for two independent circuits, it was found simpler in use to make the two circuits partially coincident, and by proper wiring to use only a single battery for producing both clicks and flashes.

an answer one way or the other each time, guessing, if in doubt.[1]

The number of trials given at each rate was never less than 100, and often more. The usual precautions against fatigue and expectant attention were taken, and to counteract the effects of practice, in part, each subject was given an hour's training before beginning serious testing. Part of the subjects, also, started at slow rates of speed, and part at fast. Of the subjects, C., P. and S. were accustomed to laboratory tests, the others not. S. had served also as subject for Miss Hamlin. The results of the tests are given in Table I, according to the subject, and in Table II in briefer form, according to the various rates of speed. In the first Table "kind" indicates whether a single pair or a series of pairs of stimuli was used. The second column gives the interval in seconds at which the pairs of stimuli recurred when the series method was used. In counting the tests each order presented was counted as one; thus 200 tests means 100 trials of the click-flash order and 100 of the flash-click order. "Time" is the interval separating the stimuli, given in thousandths of a second. The last two columns indicate the time necessary to give 75% of right answers, calculated according to Fullerton and Cattell's Table.[2]

In Table II, the results of these calculations have been collated to show at a glance the individual variations and the effects of the various rates of speed. The bracketed times represent the results of verification tests, being in each case a repetition at the close of the whole experiment of the particular form of test on which the subject began.

TABLE I.

Subject C.

Date.	Kind.	Interval in sec.	No.	Time.	% correct. C.	% correct. F.	Time necessary to give 75% rt. cases. C.	Time necessary to give 75% rt. cases. F.
Jan. 10.	Singles	—	200	74.1	67	83	114	53
" 12.	Series	3	150	15.6	70	93	20	7
" 17.	"	2	100	26.9	72	82	31	20
" 18.	"	1	100	40.0	66	78	66	35
" 24.	"	½	100	10.8	64	70	20	14
" 26.	Singles	—	200	67.5	63	62	138	150
						Av.,	61	45

[1] Further experiments, by the method of minimal changes, are now in progress. Since their completion has been unavoidably delayed, and since the series taken by the method of right and wrong cases are complete in themselves, it seems best to publish this study at the present time.

[2] Fullerton and Cattell: On the Perception of Small Differences, Univ. of Penna., 1892.

Subject P.

Jan. 10.	Series	1	200	42.5	78	100	37	—
" 11.	"	½	200	42.3	72	80	49	34
" 22.	"	2	100	20.5	88	88	12	12
" 25.	"	3	100	13.9	78	90	12	7
" 27.	"	4	100	10.7	84	68	7	16
" 29.	Singles	—	200	25.2	83	81	18	19
Feb. 3.	Series	1	100	19.1	68	82	28	14
						Av.,	23	17

Subject W.

Jan. 15.	Singles	—	200	69.4	60	89	183	38
" 25.	Series	4	100	10.6	94	96	5	4
" 27.	"	3	100	10.8	94	94	5	5
						Av.,	64	16

Subject Ck.

Jan. 14.	Singles	—	200	76.4	74	77	80	69
" 15.	Series	4	100	16.4	64	80	32	13
" 26.	"	3	100	16.6	88	96	10	6
" 27.	"	2	100	21.8	74	92	23	10
Feb. 3.	"	1	100	22.5	72	66	26	37
" 4.	"	½	100	41.6	66	66	68	68
" 14.	Singles	—	200	45.8	81	94	35	20
						Av.,	39	32

Subject Sm.

Jan. 14.	Series	1	150	38.7	78	86	34	24
" 15.	"	½	100	43.1	78	74	40	45
						Av.,	37	35

Subject S.

June 11.	Series	1	100	35.0	74	90	37	18
" 11.	Singles	—	100	53.3	84	86	36	33
" 13.	Series	2	100	22.2	78	96	20	9
" 14.	"	½	100	34.8	72	84	40	24
" 15.	Singles	—	100	50.9	80	84	41	35
						Av.,	35	24

An examination of these Tables will show that the results obtained, with few and unimportant exceptions, accord with those of Bloch, Tracy and Miss Hamlin, and are contrary to those of Exner and Gonnesiat; in other words, that the click-flash order requires a longer interval of time for recognition than the flash-click[1] order. In seeking for an explanation of her results, Miss

[1] The tendency to take the flash as coming earlier was noticed by some of the subjects themselves. Ck., for example, during one test said: "They all seem like flashes [first]. I have to work hard to make any clicks first." S. found it rare to get a click distinctly first, and hence answered "click first," for any cases where they appeared simultaneous or with the flash only slightly ahead. The flashes were commonly distinctly separate from the clicks when they actually came first.

Hamlin suggests in place of Exner's theory of optical inertia, that the stimulus of the greater attention-claiming quality will be apt to be considered first in point of time. With this view the writer of the present paper finds himself in full agreement.

TABLE II.

Subject.	Singles.				4		3		2		1		½		Av.	
	C.	F.	C.	F.	C.	F.	C.	F.	C.	F.	C.	F.	C.	F.	C.	F.
C	89	44	[138]	[150]			20	7	31	20	66	35	20	14	61	45
P	18	19			7	16	12	7	12	12	37	—	49	34	23	17
Wm	183	38			5	4	5	5							64	16
Ck	80	69	[35]	[20]	32	13	10	6	23	10	26	37	68	68	39	32
Sm											34	24	39	45	37	35
S	36	33	[41]	[35]					20	9	37	18	40	24	35	24
Average	81	41	[71]	[68]	15	11	12	6	21	13	40	29	43	37	43	28
											[28]	[14]				

The prominence of the flash in consciousness is further attested by the tendency, that nearly all the subjects noticed in themselves, to connect the click causally with the flash, which seemed to travel along the tube. If the click seemed at the end of the

tube where the flash appeared to originate, it was called first; if at the other end, the click seeming a result of the flash, like thunder after lightning, it was called last. Whether the attention-claiming powers depended on a greater intensity in the flash or a greater weakness, cannot now be said with certainty. The flash appeared to some to be a more intense stimulus to the eye than the click to the ear; to others the reverse was true. Most of the subjects felt unable to compare them. Meumann[1] found that a strong stimulus could catch the attention, and thus be placed earlier; Drew[2] that a faint stimulus had the same effect. Probably both tendencies are found under different conditions. It appears most probable that the weakness of the flash, or rather the necessity of attending to it, is the factor most effective in these experiments. The flash necessitates accommodation and a watching of the box; while the click seems to force its way into consciousness unaided. It would be interesting to repeat the experiments with a visual stimulus arranged to illuminate the whole visual field with a sudden glow, so that the elements of visual attention could be reduced to equality with the aural. Another point of interest is the fact also brought out in all of the experiments of Miss Hamlin and in most of Drew's work, that the external conditions of the experiment determine strongly the direction of the subject's attention, and that any attempt at voluntary attention defeats itself and reduces the number of correct answers.

It yet remains to speak of the effect of a series of stimuli as compared with single pairs, and of the various rates of succession of the pairs in the series. Inspection of Table II shows that the tendency to perceive the flash first is the same in all the rhythmical series as in the single pairs, and therefore that the difference of result between Exner and Gonnesiat on one hand, and Miss Hamlin and her supporters on the other, cannot be due, as she suggests, to this difference in method. It will be seen, further, that at all speeds a series of stimuli decreases the least observable interval, and that with the exception of a single subject in a single test, this time decreases directly as the length of time between the pairs of stimuli increases.

The subjects all testified that at the rates designated as 'four,' and usually at 'three,' no effect of rhythm was perceptible. S. had only occasional feeble rhythmic effect at 'two.' In these forms, the experiment is obviously reduced to ten chances of diagnosing the same single pair. For this reason the slow rates were not given to all the subjects. Under these

[1] Beiträge zur Psychologie des Zeitsinus, *Phil. Studien*, IX, 291 ff.
[2] Attention: Experimental and Critical, *American Journal of Psychology*, VII, 1895-'96, 539 ff.

circumstances, too, the extremely low intervals perceptible are not surprising. The usual method was to make a decision on the first pair, and then see if the others confirmed it. In the two-second series rhythm was generally noticeable and helpful; the one-second rate was most agreeable and pleasant; the half second very lively; the four-second "deathly slow" and "nervous." It should be mentioned that at the fastest rate the apparatus did not always function perfectly, occasionally skipping a click or flash. Subjective control and introspective analysis of method seemed also quite difficult at this rate, and here S. reported that the clicks and flashes failed to combine, but formed independent series.

To recapitulate briefly, this study has shown:

1. That the flash-click order can be recognized when the interval is shorter than that required for the click-flash order.
2. That this holds true for a series of pairs of stimuli as well as for a single pair.
3. That the serial repetition of the pairs materially reduces the time interval necessary for right judgment.
4. The cause of this seems to be a retardation of the click due to greater attention-claiming quality attaching to the flash.

XIII. The Time Required for Recognition.

By F. W. Colegrove.

The method employed in the following rough study was extremely simple. Sixty-eight pictures, three to four inches in length and two to three inches inches in height, were cut from an old magazine and pasted upon cards. These were inserted, one at a time, in the clips of the Cattell Fall-chronometer and exposed by the sudden falling of the screen. At the instant of exposure, the falling screen released one pendulum of an electrical vernier chronoscope, the other being released by the subject as soon as he was able to decide whether he had seen the picture before or not.[1] If the picture was recognized, the subject reacted with his right hand; if unrecognized, with his left. Five or six reactions to the letters R (right) and L (left) were taken before and after each sitting, and the discrimination times thus found furnish both a control of the other experiments and a means of finding the pure recognition time free of all peripheral processes.

[1] For the mode of operating the vernier chronoscope, see this *Journal*, Vol. IX, 191–7, Jan., 1898.

In the tables below, however, these simple discrimination times have not been deducted, but, on the contrary, the full time of response has been retained.

Five subjects were tested, all of whom had had some laboratory experience and two of whom had had a good deal. Five pictures, numbers 1, 2, 6, 44 and 68, were shown each subject before beginning and he became familiar with them. He also saw them again before each sitting. In what follows they are termed the "well-known pictures." On the first day of experimenting these were shown in irregular order with other pictures from the series. On the second day both the "well-known pictures" and the new ones of the first day could be drawn upon as known pictures to mix with a second group of unknown pictures; and on the third day the pictures of both the first and second days, and so on.

A considerable mass of records was thus obtained, both for the time required for recognizing the "well-known pictures," and for the time required for other pictures after one, two, three, four or more exhibitions. It is hardly necessary to mention that the first recognition, except in cases of mistaken reactions, occurs on the second exhibition and so on. The results for the earlier and later recognitions of the well-known pictures are given in Table I. In forming this table, the series of recog-

TABLE I.

Showing Times for Signaling the Recognition of the Well-known Pictures; Times in 0.001 Seconds.[1]

	EARLIER RECOGNITIONS.			LATER RECOGNITIONS.		
Subject.	No. of Obs'vat'ns.	Time of Recognition.	M. V.	No. of Obs'vat'ns.	Time of Recognition.	M. V.
W	15	524	58	15	451	35
Y	22	490	119	27	432	38
S	17	615	65	19	516	55
K	23	571	124	26	474	68
Q	23	434	110	23	424	71
Average,		527			459	

[1] The times are given in the usual unit for convenience of the reader, though, as the unit of the chronoscope itself was 0.02, no significance is attached to the third figure of the results. It might be expected that with the method of division described in the text the number of

TABLE II.

Showing Times for Signaling Successive Recognitions of Pictures other than the Well-known Group.

	W			Y			S			K			Q		
	No. of Obs.	Time.	M. V.	No. of Obs.	Time.	M. V.	No. of Obs.	Time.	M. V.	No of Obs.	Time.	M. V.	No. of Obs.	Time.	M. V.
1st rec.	19	705	111	33	550	100	15	644	129	26	625	124	25	490	95
2 "	15	597	82	26	516	99	15	667	101	28	634	139	14	533	98
3 "	6	527	47	13	522	75	6	550	73	17	606	114	4	465	83
4 "	2	530	50	3	587	142	1	540	60	12	515*	78	1	620	—
5 "	1	480	—	2	470	10	1	620	—	5	496	59	1	520	—
6 "	1	440	—	—	——	—	—	640	—	1	540	—	—	——	—
7 "	1	500	—	—	——	—	—	——	—	1	520	—	1	400	—
Average	45	622		77	533		40	633		90	600		46	502	

* One record, nearly 3 times as large as any other, was omitted from this average.

nitions for each picture was divided in the middle, if the number of recognitions was even, and the first part taken for the column of earlier recognitions, the second for that of later recognitions. If the number was odd and the full series could not be evenly divided, the middle term was discarded and the remaining parts treated as if the series had been even.

These figures show that the full time of signaling the recognition of a well-known picture lies somewhere between 424 to 615, and that it is shorter in the second half, where the familiarity was greater. This quickening may be due in part to increased skill in reacting. Two of the five subjects show a similar gain in reacting to the letters R and L, and with one subject, Q, the difference is more than that between the early and late trials in Table I, making the pure recognition times respectively 68 and 89. But it must be due chiefly to increasing familiarity with the pictures. Four of the five subjects show the same relation in the pure recognition times as in the table. The average pure times, found by subtracting 316 and 311 from 527 and 459 respectively, are 211 and 148.

The same thing is shown, though somewhat irregularly, when the successive recognitions of other pictures are examined, as in Table II.

How this increased speed of recognition should be regarded, whether as a hastening of the recognition process or as a gradual change in the character of that process from one which is more or less conscious toward one which is wholly automatic, or as involving both tendencies, is, unfortunately, not shown by the data at hand.

Beside this general question there are several of a subordinate interest, namely: Is there any difference in quickness of response when a picture is signaled as unrecognized? Is the quickness of response different when errors are made, *i. e.*, when a known picture is signaled as unknown, or *vice versa*? Is there any difference in the quickness with which different pictures are recognized? Such data as the experiments have furnished upon these points are gathered in the following paragraphs.

In Table III the time for the *first recognitions* has been taken from Table II, instead of the average time of all recognitions, as corresponding more nearly with the condition present when the pictures (before unknown) are signaled as unrecognized. It will be observed that three subjects (W, S and K) take longer to determine and signal a recognized picture than an unrecognized one; and two, Y and Q, take longer for the unrecog-

observations would be the same for the same subject in both early and later recognitions, and such would be the case except for differences introduced by failures in the functioning of the apparatus, and by erroneous reactions on the part of the subjects.

TABLE III.

Showing Comparative Quickness in Signaling Recognized and Unrecognized Pictures.

	RECOGNIZED PICTURES.			UNRECOGNIZED PICTURES.		
Subject.	No. of Cases.	Time.	M. V.	No. of Cases.	Time.	M. V.
W	19	705	111	52	618	111
Y	33	550	100	40	583	88
S	15	644	129	48	587*	95
K	26	625	124	49	586	121
Q	25	490	95	43	564	99

*One record, nearly four times as large as that next it in size, was omitted in making this average.

TABLE IV.

Showing Comparative Quickness in Erroneous Reactions.

	WRONGLY SIGNALED AS KNOWN.			WRONGLY SIGNALED AS UNKNOWN.		
Subject.	No. of Cases.	Time.	M. V.	No. of Cases.	Time.	M. V.
W	9	624	200	20	617	88
Y	19	536	118	27	586	116
S	6	550	137	15	635	98
K	10	614	128	31	570	105
Q	16	461	71	10	516	140

nized. This appears to be due to a difference in mental attitude, which will perhaps be clearer after a consideration of the results where errors were made. Y, Q and K show the same tendencies in Table IV as in Table III; the times of W when in error are practically the same without regard to the nature of the error; while for S the relation of Table III is reversed. The small number of cases and the large M. V. make it seem likely that this difference in the case of S is accidental, and examination of the separate determinations confirms that opinion.

The proportion of errors of each sort for the different subjects is, however, more characteristic than the times. The percentage of cases in which the error consisted in signaling as known a picture which had not really been seen before, is as follows: W 31, Y 41, S 29, K 24 and Q 62. W, S and K evidently tend less to false recognitions than Y and Q. Furthermore, if the records of the observers in all the tables be compared, it will be found in every case that subject Q made the quickest responses, and that in every case but one (*i. e.*, in wrongly signaling known pictures as unknown, Table IV, second half), Y stands next him in speed, while K, W, and S are always slower, though their order among themselves is different in different tables. Y and Q appear to err by being hasty.

The first inference, perhaps, would be that Q and Y belong to the motor type of reagents and carried their motor habit into these recognition experiments; and there was more or less in Q's manner of reacting to justify such an inference. Yet, if this were the case, something of the same tendency ought to appear in the records for signaling the presence of the letters R and L. The records, however, fail to show such a tendency; Q is slow as compared with the rest, and Y, though quick in the early part of the series, was excelled by both S and W in the latter part. It seems more probable, therefore, that Q and Y were somewhat on the lookout for known pictures, while the rest expected unknown pictures.

The grading of the pictures according to their difficulty of recognition was made on the basis of the errors recorded against them and checked by a subsequent calculation of the times required for certain special groups; all of the "well-known" pictures were excluded in this consideration.

Ten pictures had no errors at all or but a single failure in recognition recorded against them. They gave, together, thirty-three recognition times, with an average value of 568, and a M. V. of 111. Six pictures, on the other hand, failed of recognition on four or more occasions. These gave, together, ninteen recognition times, with an average value of 583 and a M. V. of 155.

Any statement of reasons for this slowness must be largely conjectural, but the pictures recognized with difficulty seem lacking in interest, either in the situation presented or because they involve a multitude of nearly co-ordinate details. The pictures that were most often recognized falsely (*i. e.*, signaled as known when shown for the first time), were a group of three drawings of country houses, all executed in a similar and somewhat peculiar manner, and not easily distinguishable in their general aspects, though offering no difficulty when placed side by side. Next these in suffering errors of this kind was a group of eleven

pictures, a number of which showed resemblance in subject or treatment to other pictures in the series. As was to have been expected from the nature of the experiment, the general effect is more important in both cases than details.

The general results of this study may be summed up as follows: The central processes of recognition in the case of ordinary magazine pictures take place in a fifth of a second or less, on the average, the time decreasing as the familiarity increases. Whether the judgment that a picture is known takes place more quickly than the judgment that it is unknown, seems to depend on the mental attitude of the subject—more quickly if he expects the exhibition of known pictures, less quickly if he expects the reverse. Differences in the facility of recognition are found with different pictures, depending chiefly, it would seem, upon their ability to arouse interest, or, in other words, to compel attention.

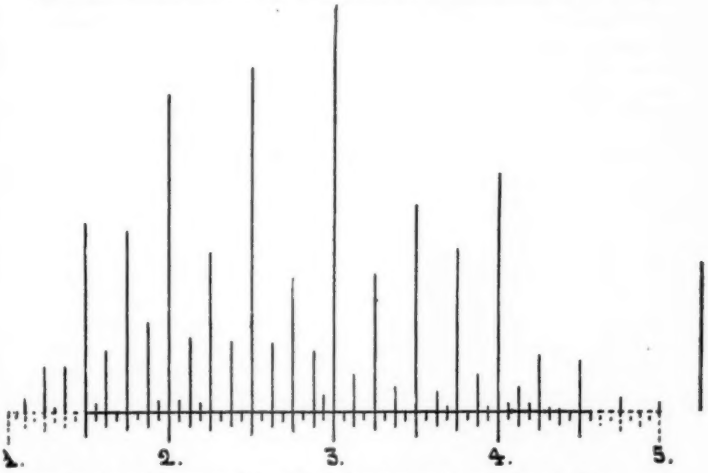
XIV. Notes on Mental Standards of Length.

By F. W. Colegrove.

The ability to make estimates of length presupposes some sort of mental standard which is applied to the length in question. The existence of such standards is very easy to demonstrate, and has even been found a serious obstacle in certain forms of psychophysical experimentation. Some effort has been made to find how accurately these mental standards coincide with the external units that they represent, but so far as the writer is aware no one has tried to investigate the nature of these scales and their mode of application. The present fragment unfortunately does not go far toward filling this gap, but may, at least, call attention to the matter as a subject for investigation. It would be interesting from the point of view of individual psychology if we could know, for a considerable number of persons, the nature and origin of their full equipment of mental standards—for weight, capacity, temperature, angular measure and money value, as well as for length.

The method of the present study was simple in the extreme, and the results can be briefly stated. Fifty circles, differing in diameter by sixteenths of an inch, and forming a continuous series from one and a half inches to four and nine-sixteenths inches, were drawn upon cards of convenient size. A similar set of straight lines of length equal to the diameters of the circles was also prepared, and was submitted with the circles to the subjects for estimation. The subjects were ten in num-

ber, including one who estimated the circles but not the lines. Six were university students (four were of the psychological department), and of the remaining four, one was the wife of a university student, one a carpenter, and one an expert machinist. The combined results of both series and for all subjects are exhibited in the following diagram. The short lines



projecting downward from the horizontal are intended to represent the objective scale, as ordinarily cut on measuring rules. The portions at the left of the one and a half inch mark and to the right of the four and nine-sixteenths inch mark are put in in broken lines to indicate that while not actually found on any of the cards presented, they were trespassed upon by estimates of the subjects. The longer lines erected upon the upper side of the horizontal are intended to indicate the relative frequency of estimates of the extent given by the division of the scale above which they stand. The estimate "three inches," for example, was recorded 110 times; that of "two and fifteen-sixteenths" (next line to the left) 4 times; that of "three and one-eight" (next line to the right) 10 times. The detached line at the extreme right shows the relative frequence of estimates based upon other than the 2, 4, 8, 16, division of the inch; they were chiefly thirds, with occasional fifths and sixths; no other irregular fractions were given by the subjects.

It is easy to see from the diagram that estimates in sixteenths are infrequent. The eighth divisions are maintained throughout from one to four and a half inches. The quarters

are well marked, and the halves and whole inches best of all. The estimate "three inches," approximately the middle extent of the range used, was the most frequently given. In the eighths and quarters there is, as might be expected, a tendency to diminish in frequency from left to right, and this would doubtless have been much more marked had the range been more extended. Such a decrease in the fineness of the estimation scale with increase in its extent is easily verified in introspection, and is probably a case of the same sort of relativity that finds expression in Weber's Law, at least in its application to visual extents.

In a certain sense the diagram above may be said to represent the average mental scale from one and a half to four and a half inches, but it is in no sense to be taken as a picture of such a scale. The mental scale is probably a much more complex affair. It seems likely that most of us carry separate standards for the principal extents; 1, 1½, 2, 2½, 3 inches, and so on, and in estimating, classify first according to these. Then, if pressed for finer judgments, we estimate the excess or defect of the given extent in comparison with the nearest of these standards in such fractions of an inch as we have at command, and so arrive at a final estimate. The grouping of the sixteenths near the whole inches to be observed in the diagram, would accord well with such a process.

The subjects showed considerable individual differences in their fineness of estimate. Of the twenty-two estimates involving sixteenths, seventeen were given by the machinist, four by the lady and one by one of the psychologists.

Several subjects rarely estimated in eighths, and one used no eighths and only five quarters in fifty judgments. These differences are doubtless largely due to differences in practical familiarity with the measuring rule, but also perhaps in part to a difference in the seriousness with which the task was undertaken. The unusual fractions, thirds, fifths and sixths, were used to some extent by five subjects; with one exception, by those whose scale was not otherwise very finely divided. The use of these unusual divisions seems to indicate reliance upon a standard inch divided off-hand as occasion required.

The experiments, as arranged, were not adapted to test the objective truth of the estimates, but there seems to be a general tendency toward under-estimation. It was expected that this would be marked in the case of the circles, following the well-known illusion which affects circles when compared with squares of equal breadth, but the circles do not appear to have been more underestimated than the lines.

With a view of studying the ability of the subjects to estimate extents of less than an inch, the following variation of the

experiment was tried with eight of the previous subjects, the machinest not being included, however. A Brown & Sharpe micrometric gauge was set at the even tenths of an inch from 0.1 to the full inch and the subjects were asked to estimate the separation of the jaws. In this case all the subjects but one used divisions as fine as sixteenths, and one went as far as sixty-fourths. The remaining subject gave no fraction with larger denominator than six. One gave estimates in unusual fractions (thirds and fifths) but no one ventured on a decimal division.

Other tests were made in which the subjects drew their standards for the whole inches from one to five, and still others in which the lines were estimated from memory after a few minutes interval, but not in sufficient number to warrant presentation of the results.

NOTES ON THE CASTRATION OF IDIOT CHILDREN.

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Dr. Robert Boal read before the Illinois State Medical Society a paper under the title "Emasculation and Ovariotomy as a Penalty for Crime and the Reformation of Criminals."—*Jour. Am. Med. Association, Sept., 1895.*

Dr. A. Lapthorn Smith, Montreal, Can., reports the case of Miss X., age 25, ovaries and tubes removed 7 years ago. Still has the same sexual feeling as before and indulges excessively.

Dr. E. J. Munroe, of Bordeaux, reports observations in two cases of ovariotomy in young women, which showed an effect on the voice exactly the opposite of what is brought about in the male by castration. The higher notes were lost and the voice fell from soprano to mezzo-soprano.—*Boston Med. and Surg. Jour.*

In a paper entitled "The Crimes of Medical Men," in the Medical Herald for June, 1896, Dr. W. O. Henry mentions as one crime the failure to urge legislation to prevent marriage of criminals or to have them castrated.—*Record, Sept., 1896.*

In the Annals of Surgery, Sept., 1896, Dr. A. T. Cabot discusses the question of "Castration for Enlarged Prostate," in which the writer takes, on the whole, an unfavorable view of the operation as compared with the older one of prostatectomy. Dr. White, one of the editors of the Annual, combats some of his conclusions. "The large proportion of cases mentioned by Dr. Cabot in which mental disturbance followed the operation is noteworthy, even if it is not directly attributable to the operation." A large mortality has followed the operation of castration in the aged for enlarged prostate.

Dr. Pilcher, Supt. of the Institute for Imbeciles and Weak Minded Children, at Winfield, Kan., has been bitterly denounced

by newspapers in Winfield and Topeka for castrating several boys, inmates, who were confirmed masturbators. His predecessor, Dr. Wile, had treated these boys five years without benefit, and Dr. Pilcher, taking a rational view of the subject, performed the operation for the same reason that he would perform any other surgical operation—for its curative effect. There is a strong probability that he will be indicted for mayhem, to the everlasting disgrace of the civilization of the nineteenth century.—*Texas Med. Jour.*

The House Committee on Public Health of the Kansas Legislature has made a favorable report on the bill which does away with the penitentiary sentence for men convicted of assaulting women, and substitutes castration. The Social Purity League of Topeka has been urging the passage of this bill, and the leaders of the league claim enough votes in both houses to pass it, and have secured the promise of Gov. Leedy's signature. They say that following the lead of Kansas, ten other States will pass the same law at their next session of legislature.—*Med. Record.*

"Castration in cases of sexual perversion and for habitual criminals has been revived in able papers read before the Chicago Medico-Legal Society, by Daniel, of Texas, and Way, of the Elmira Reformatory. The arguments advanced did not receive a very cordial endorsement from the members present, and the possibility of the adoption of the measure advocated is slight. It is too radical a change to be made in a hurry, and the fact must not be lost sight of that any such experimentation is contrary to the laws of nature and will receive almost universal condemnation."—*Cutting.*

A writer in the London Lancet gives us some information on the subject of the demand and supply of eunuchs in China. The emperor and certain members of the royal family are alone entitled to keep eunuchs. His majesty maintains at least 2,000, but no prince of the blood or imperial princess has a right to more than 30. In the production of Chinese eunuchs four chief factors prevail, viz.: greed, predilection, poverty and laziness. Many parents sell their male children to the mutilators, or themselves castrate them in the hope of eventually sharing their earnings. Both penis and scrotum are removed by a single sweep of the operator's knife or scissors. A small piece of wood or pewter is inserted into the open urethra and the wound washed with pepper and water. The patient is then walked for three hours without rest, and for the following three days he is allowed no drink, while the plug fills the urethra. On the fourth day the plug is removed and if the urine flows he is looked upon as cured; but, should the overstrained bladder refuse to act, he is left to die. Fatal cases amount to about three per cent.

"In Siluria boys are castrated in a certain village and dressed in women's clothes."—*Uncertain authority.*

Hammond refers to castration as a religious ceremony in New Mexico.

There is a wide-spread belief that squirrels castrate each other, but after reading much pro and con I feel pretty well satisfied that the very frequent cases where the testicles are missing is due to a parasitic disease which destroys the gland.

Dr. Edmund Andrews, of the Northwestern University, Chicago, writes for the American Medical Journal of Jan., 1898, that the following effects of castration on animals are noted. The elk experimented upon did not shed their horns in the following season, as is usual with them, but the old horn remained. The severe weather froze the horn at the tips and these tips came off and then numerous small sprouts came out. These in turn were nipped in the following season and sprouted in smaller parts and this went on until a pair of large nobby bunches of bone stood up on the heads. If protected, these horns would probably attain an immense growth.

The ox. When the calf is castrated he grows to be a larger and taller animal than the bull but his neck and forequarters are thinner. His cerebellum becomes larger than that of the bull and his horns become both thicker and longer. The voice is changed in pitch while lowing but not in bellowing.

The horse grows larger if castrated young and the bridle teeth do not seem to be changed as occurs in the full male.

Sheep. The wethers do not become especially larger. The wool of the ram is, however, much more oily and of less value.

The cat. These animals grow larger and are good mousers. They are fonder of petting.

The capon, castrated chicken, grow larger, the flesh is delicate, the spurs undeveloped, the colored comb and wattles remain small. Some of them develop a nursing instinct and take good care of a brood of chickens.

In general terms, if an animal is castrated young he develops the distinctively male peculiarities in only a slight degree, yet some species produce much larger horns than the perfect male. The ox and gelding do not completely lose their sexual passion, but make frequent efforts to copulate with the females in heat.

Physical effects of castration in man seem to be that if castrated young they grow taller and have larger frames. They are also fatter. The hair on pubes and face does not grow. Cheeks look round and prominent, chin apt to be double, no beard. The voice in boys below age of puberty is about like that of a woman, but after puberty it is found an octave lower than that of the woman. The timbre never attains the richness and flute-like splendor of the adult woman.

Mental effects of castration. If castrated late in life the sexual desires are not abated, but if in early childhood it is practically lost. Eunuchs are charged with special envy and jealousy, but this does not seem substantiated. They are only zealous in their duty of defending the women whom they are in charge of.

Dr. Robert P. Harris, of Philadelphia, in an article on Congenital Absence of the Penis, in Philadelphia Medical Journal of January 8th, 1898, offers the following conclusions among others: The eunuch has usually longer legs, a light pelvis, and is defective in the growth of his chest and arms. His long bones are light and have a larger hollow in them than in the full man. If not taller, he is often very fat, and attains a weight of 200 or 300 pounds.

"A complete antithesis to the Jumpers is presented in the sect of the so-called White Doves or Skoptzi. These are a secret sect in Russia, belonging to the Christian belief, but secretly practicing castration, and believing that thereby they insure purity. They are certainly a wonderful people, with many excellencies, though fanatics in this belief."

An editorial in the Journal of the American Medical Association of October 23d, 1897, concludes that the psychic and physical effects of castration are less pronounced the later in life the operation is performed. The general argument is in favor of great care in performing the operation in women, and a conservatism that has not as yet been practiced.

Castration is hinted at in Mat. xix, 12; Deuteronomy xxiii, 1, two mutilations analagous to complete castration are mentioned.

A castration bill was introduced into the Michigan Legislature providing for the castration of all inmates of the Michigan Home for the Feeble-Minded and Epileptic before their discharge; also for that of all persons convicted of a felony for the third time, and of those convicted of rape, in 1897.

Of the 26 male cases here operated on, 24 were operated on because of persistent epilepsy and masturbation, one for epilepsy with imbecility, and one for masturbation with weakness of mind.

The results of the tabulation show that the cases were at time of operation about half of them under 14, four 16, five 17, two were more than twenty, and the balance of 15. The time since the operation has been in most of the cases some years, but in four the operation has been done within a year. The mortality has been nothing, and the operation is regarded as very safe and simple even with adults, though there has been a high mortality in the aged castrated for enlarged prostate.

In these cases they have been operated on under an anesthetic and some have been circumcised at the same time. A large

number of other cases have been circumcised alone and all with good results.

Two of these cases had large varicocele which was all cut away at the time of castration.

The mental and moral condition was fair in 9, good in 2, and poor in the others; this has become better in 3 cases and remained unchanged in the rest; two were kleptomaniacs, and this manifestation has nearly disappeared since the operation; one was salacious, improved since operation; one was solitary, not so much so now; four were passionate and quarrelsome and are now much less so; one persistently eloped but now never attempts it; two were gluttonous and remain so; one was monkeyish and is still much the same; one was imbecile and is now more so; four ceased to have fits, though without much mental change, soon after the operation; the voice remains soft in five cases and is not perceptibly altered in the others. Masturbation has ceased in all the cases but one; that comes on at times only and lasts for a few days.

In one of the female cases, not included in the 26, masturbation is quite prominent at intervals, but at such times the girl is insane and demented. There has been gain in weight, aside from growth, in all cases but 3. The sexual appetite seems to be now missing in all the cases but 2, and in them appears only periodically. Erections sometimes occur but without erethism except in the instances where masturbation still occurs. No extra growth of legs or body has been noted in these cases, and could not well be, as they are nearly ali still in the growing stage and have not as yet shown abnormal size. The temper has been improved in all instances but 4, where it remains unchanged. There is less pugnacity in all the cases, and less of anger, obstinacy and self-will. It seems that the cases grow more sympathetic and altruistic, and in some the emotional nature in general is better balanced and more nearly normal.

In all these cases the written consent of the parents has been obtained.

This class of work has been very little done anywhere, as public opinion has been much against it, and even among medical men no encouragement has been given until recently.

The effect upon the epileptic seizures appears to have been good in all cases. Some have ceased having the attacks altogether, though one has had an attack after two years of immunity, but it was brought on by over-eating. All the cases have the attacks less often and with less severity.

Only five of these cases have had bromide since the operation and they with diminishing doses, now reduced to five or ten grains once daily. All the others have been without medicine,

except that they have had tonics, such as Co. Tinct. Gentian, and cod liver oil, at intervals.

Fourteen of the cases are Americans, six Irish, one Scotch, one Swedish, the others being of unknown extraction. At present, 17 of the cases still reside in this Institution, 3 are in lunatic hospitals, five are at home with parents, and the whereabouts of one unknown.

ON THE WORDS FOR "FEAR" IN CERTAIN LANGUAGES. A STUDY IN LINGUISTIC PSYCHOLOGY.

By ALEX. F. CHAMBERLAIN, Ph. D., Clark University, Worcester, Mass.

In a previous essay[1] the writer discussed anger-words, and reference to this will be necessary since not a few fear-words are akin to those used to denote anger.

I. *Fear*, if we trust the etymology of its English name, is "an *experience;*" Skeat tells us that the word was "originally used of the *perils* and *experiences;* of a way-*faring*." The Anglo-Saxon *fáer* meant "a sudden peril, danger, panic, fear;" cognate are Icelandic *far*, "bale, harm, mischief," Old High German *fára, vàr*, "treason, danger, fright," Modern German *Ge-fahr*, "danger, peril, risk." Related also are: Latin *periculum*, "peril, trial, danger" (from *perior*, the root of *peritus*, "experienced, skilled"), *experientia*, "experience, trial, proof;" Greek πειρα, "attempt, stratagem, trick," περάω "I go through." The common radical of all these terms is the Indo-European root Per, "to pass through, to travel, to *fare* (as our own English word from the same stock has it)." In Old Norse *fár* has the additional signification of "plague, pestilence, misfortune," which may go to somewhat explain our expression "a plague of fear." *Fear*, then, emphasizes "what one has *passed* through."

II. "All of a *tremble*" is a popular description of the state of fear or terror, and not a few of our fear-words contain this primitive idea. We say "*trembling*, *shaking*, *quaking* with fear," and these expressions find their analogues in many other tongues. George Fox tells us in his "Journal" that "Justice Bennet [in 1650] was the first to call us Quakers, because I bade him quake and tremble at the word of the Lord," and all over the world the "fear of the Lord" has been largely associated with *quaking* and *trembling*.

The English word *terror* (French *terreur*, Latin *terror*), goes back to the same root which gave birth to Latin *terrere* (older form, *tersere*), "to dread, to be afraid," and, originally, "to tremble;" Russian *triasti* (*triasate*), "to shake, to shiver;" Lithuanian *triszëti*, "to tremble;" Sanskrit *tras*, "to tremble, to be afraid," *trása*, "terror"—the radical of all being Indo-European *ters*, "to tremble, to be afraid." Of similar meaning, ultimately are *tremor* and cognate words derived from the Latin, and the derivatives of Greek Τρέω, "I tremble, quake, fear, dread, am afraid of."

The German *Furcht* (the Middle High German *vorhte* signified "fear, anxiety, apprehension") is the abstract of the verb *fürchten*," cognate with Gothic *faúrhtjan*, "to fear, to be afraid of," to which is related the adjective-participle *faúhrts*, "fearful, timid," *faúrhtei*, "fear." The Teutonic radical *fork*, together, perhaps, with the roots of Latin *querquerus*, "shivering with cold," and Greek χαρχαίρω, "I tremble," goes back to the Indo-European *perk* or *qerk*, "to tremble." Another word embodying the same idea is Gothic *reiro*, "tremble, terror"—*reiran*, "to tremble." To "tremble like an aspen" is

[1] *Amer. Jour. Psychol.*, Vol. VI, pp. 585-592.

a very ancient Indo-European figure of speech. The Latin *pavor*, "quaking, trembling, throbbing with desire, joy, fear," "anxiety, fear, dread,—the god of fear is personified as *Pavor*,—to be afraid, to fear, to tremble," and the Greek Φόβος, with all the *phobias* to which it has given rise in the various civilized languages, have at their base radicals which signify "to tremble." The corresponding verbs in Greek Φοβέω and Φέβομαι are related to Sanskrit *bhî*, "fear," *bibhéti*, "he is afraid," Lithuanian *bàimé*, "fear," *bijétis*, "to be afraid," *bajùs*, "terrible," *baisà*, "terror," while the modern German *beben*, "to tremble, quake," goes back to the same Indo-European radical.

We speak in English of "shivering with terror, or fear," and it is interesting to note that in the "Gest Hystoriale of the Destruction of Troy," an English Romance *circa* 1390 A. D., we find "Achilles at the choice men *cheuert* (shivered) for anger."

The French word *craindre*, "to fear," belongs here also, being derived from the Latin *tremere*.

The radical meaning of English *shudder* is to "tremble."

III. Another closely related series of words is that in which the basal idea is *agitation, movement, stir*. Here belong the Latin *metus*, "agitation, anxiety, fear, dread, terror," *metuere*, "to fear, to be afraid of,"—allied perhaps to *mōtus*, "moved, affected, disturbed." *Trepidation*,—the Latin *trepidatio* signified "confused hurry, alarm, consternation, terror, trepidation,"—has a curious etymology. Festus, the ancient grammarian, glosses the old Latin *trepit* by *uertit*, adding the remark "unde *trepidus* et *trepidatio*, quia turbatione mens uertitur." The Latin adjective *trepidus*, "trembling, alarmed, fearful, anxious," etc., would then seem to signify "in a state of disturbance, as if the mind is being continually *turned* about or agitated (Skeat)." The Old Latin *trepere* is cognate with Greek Τρέπειν, "to turn," and also with Latin *torquere* (whence *torture*), the basis of all being the Indo-European radical *t-rk*, "to turn, to twist." So when we speak of being *tortured* by our fears we are but repeating a very old figure of speech. A coward we often say "*writhes* with fear."

IV. A common expression in English is "to *start* with fear," with which may be compared the colloquial "to almost *jump* out of one's boots;" we have also the derivative "to *startle*." The same idea is at the basis of the modern High German *Schreck*, "terror, fright, fear, horror," the Old High German verb *scrëckôn* signifying, "to start up, to leap, to hop," the Middle High German substantive *schric*, "a sudden start, terror," and the causative verb *schrecken*, "to cause to start, to make afraid." The radical is *skrik*, "to leap, to move suddenly, to start."

A cognate idea resides in the Modern German *sich entsetzen*, "to be startled at, to be terrified, to shudder," and the substantive *Entsetzen*, "terror, dread, horror, fright." The Middle High German *entsetzen* signified, "to cast down, to disconcert, to fear, to be afraid of," the Old High German *intsizzen* (there is also a M. H. G. from *entsitzen*), "to come out of one's seat, to lose one's composure, to fear, to be afraid of." In Gothic we find *andasēts*, "horrible," *andsitan*, "to be terrified." These words are all based upon the Indo-European root *sed*, "to sit," with a privative, or disjunctive prefix (Mod. German *ent*, Gothic *and*). The idea at the root of *Entsetzen*, is "starting from one's seat in terror."

V. The sinking of the heart and of the vital organs generally is a familiar conception of "fear" among primitive peoples, and one which appears very often in picture-writing and sign-language, as Col. Mallery has pointed out. Our own language furnishes cognate expressions, "to have one's heart in one's boots," "to feel one's

heart sink," etc. Being "down-hearted" is thus a very early form of fear.

Perhaps, here belong also the Yoruba (a West African language) *ai ya fŏ mi*, "I am afraid," literally, "the heart jumps me," *daiyafo*, "to frighten," etc., although the jumping is here the other way. We say, analogously, in English "my heart leaped into my mouth," in speaking of certain aspects of fear.

VI. The ghost in "Hamlet" describes several of the known symptoms of fear:

> "I could a tale unfold, whose lightest word
> Would harrow up thy soul, freeze thy young blood,
> Make thy two eyes, like stars, start from their spheres,
> Thy knotted and combined locks to part,
> And each particular hair to stand on end,
> Like quills upon the fretful porpentine."

The last mentioned symptom is illustrated by the etymology of the word *horror*. The Latin *horror*, "a standing on end, bristling, terror, dread," and *horrere*, "to stand erect, to bristle, to be afraid, astonished, amazed, to startle with fear," etc., as the older form (*horsere*) of the verb (cf. *hirsutus*, "rough, hairy, shaggy") shows, refer to the "bristling of the hair in fear." In Sanskrit *hirsh*, "to bristle," is said of the hair, "especially as a token of anger or pleasure" (Skeat).

Virgil refers to the bristling of the hair in the *Aen.*, II, 774:

Obstupui, steteruntque comæ, et vox faucibus hæsit.

VII. The "freezing of the blood" finds cognate expression in some of our fear-words, and besides we speak often enough of "the cold shivers" of fear, and "the cold sweat" that accompanies it. Our English *afraid* is the past participle of the verb *affray* "to frighten," which Skeat traces through the Old French *effreier* (effraier, esfreër), "to frighten," to a Low Latin *exfrigidare* (from *frigus*, "cold"), "to freeze with terror,"—in Latin *frigidus* meant "dead or stiffened with cold or fright," and Horace even uses it in the sense of "fearful." A common phrase in English is "*numbed* with fear."

VIII. Our English *dismay*, "to terrify, to discourage," comes, according to the Skeat, from Old French *dismayer* (cf. Spanish *desmayar*, "to dismay, to dishearten, to be discouraged, to lose heart"), which seems to have been supplanted very early by the verb *esmayer*, "to dismay, to terrify, to strike powerless"—the intransitive sense of which "to lose power, to faint, to be discouraged," would appear to be the older. *Desmayer* and *esmayer*, according to the best authorities, are derived from the Old High German *magan* (Mod. Germ. *mögen*, Mod. Engl. *may*), with the Latin prefixes dis-, ex-. The "loss of power" is the basal idea here. From Old French *esmayer* comes Modern French *émoi*, "fright, terror." Cognate also is the Italian *smagare*, "to lose courage." The English word *misgiving* has somewhat of the idea in *dismay*. With us, in English "to lose heart" is "to give way to fear."

IX. The Latin *consternatio* (whence our *consternation*), signified "consternation, fright, tumult;" the corresponding verb is *consternare*, "to stretch on the ground, to prostrate, to terrify, to alarm, to dismay"—the participle *consternatus* meaning "cast down, prostrate, frightened." The basal idea is seen in Latin *sternere*, "to throw down, to throw to the ground," from the Indo-European radical *st-r*, "to spread out." We employ a somewhat similar figure when we speak of "*abject* fear."

X. We often speak of persons being "rooted to the ground with

fear," "transfixed with fear," etc.; from fright people often stand "stock still." In Gothic we find *usgaisjan*, "to terrify," *usgeisnan*, "to be terrified," cognate with Old Norse *geiska-fullr*, "filled with terror," and Lithuanian *gaïszti*, "to swoon." Related also is the Latin *hærere* (older form *hæsere*), "to cling to, to stick, to be unable to move away"—the radical of the whole series being Indo-European *ghais*, "to stick." We still say of a valiant man that "he will not *stick* at anything."

BOOK NOTES.

G. S. H.

Die Ideenassoziation des Kindes. VON TH. ZIEHEN. Berlin: Reuther und Reichard, 1898. pp. 66. Price, Mk. 1.50.

A scientific study of the association of ideas, Professor Ziehen notes with surprise, has scarcely yet been made; although from a theoretical, no less than a pedagogical, point of view, no field promises richer results. Galton has, it is true, done something with the associated ideas of adults, but in the domain of genetic psychology one finds only the most incidental references to the subject, and Professor Ziehen's study is an attempt to break new ground. His test was carried on with forty-two boys, from eight to fourteen, in the practice school connected with Rein's Pädagogische Seminar at the University of Jena. Certain monosyllabic words — the names of well-known objects — were at stated intervals pronounced to the boys and they were required to give the immediately suggested idea. The children usually answered in a word and these answers, or associated ideas, Professor Ziehen groups (1) rapid (springende) associations and (2) reasoning (urteils) association. "Rose—red" illustrates the first group. There is manifest absence of reasoning, and ideas of time and space are not taken into consideration. In the second group the child answers, "The rose is red." Here a definite rose is considered and time and space are indicated. The idea presented is also connected with the resulting idea.

Verbal associations constituted less than 2% of the associations made by the children, but Professor Ziehen concludes that such associations are more common among adults and most common in persons having mania or some form of mental debility. A form of association—somewhat related to verbal association—namely, word-completion, he found more general among the children, as, for example, postal—card; heart—shaped; post—office, etc. The most significant facts brought out in Professor Ziehen's study are (1) the universal application of the law of contiguity with the young child—only in verbal associations was there any hint of the working of the law of similarity, and the verbal associations, it will be recalled, were not numerous; and (2) the strong emotional element in the associated ideas of children. This, says Ziehen, explains why the memory-images of school excursions form so readily and are reinstated so easily.

WILL S. MONROE.

Studien und Versuche über die Erlernung der Orthographie. Von HERMAN SCHILLER. Berlin: Reuther und Reichard, 1898. pp. 63. Price, Mk. 1.50.

The spelling problem, notes Professor Schiller, in his introduction, is far from settled—German contemporary pedagogical thought to the contrary, notwithstanding. The results obtained in the schools, which are far from satisfactory, justify some investigation into the psychological basis of accurate spelling. The customary way of acquiring word-forms, assumes the author, is primarily through the eye and the ear. In order to have the accurate orthography of a word, the pupil must *hear, see, pronounce* and *write* the new word; and in order to

test the relative value of visual, auditory and motor methods in spelling instruction, Professor Schiller devised a series of words which were in eleven different ways propounded to classes of boys ranging in age from eight to nine. The following were the variations of the tests: 1. Words pronounced by teacher, the pupils holding their mouths firmly closed; 2. Words pronounced by teacher, the pupils repeating the same in a low tone; 3. Words pronounced by teacher, pupils repeating the same in a loud tone; 4. Words pronounced by teacher, and the pupils write the words in the air; 5. Teacher writes the words on the board, the pupils close the mouth firmly, and look at it an instant; 6. The same, the pupils pronounce the words in a low tone; 7. Same, the pupils pronounce the words in a loud tone; 8. Same, the pupils write the words in the air; 9. The teacher pronounces the words, the pupils spell the same, that is, name the letters and syllables in the words; 10. The same, the pupils pronouncing the words in low tones; 11. The same, the pupils pronouncing the words in loud tones.

Each test was repeated eight different times with words which had not been taught to the boys and which must have been more or less new to them. The efficiency of the different methods was judged by the errors made in subsequent efforts to correctly render the lists of words learned. It should be borne in mind that each list had eight repetitions; and, as to relative size and difficulty of words in the different lists, the balances were pretty approximate. The following comparison with regard to errors made suggests the efficiency of current methods of teaching spelling: Words written on board by teacher and copied by pupils, they pronouncing at the same time in low tones, 277 errors; the same, pronouncing in loud tones, 298 errors; words written on the board by teacher, and then written in the air by the pupils, 344 errors; words pronounced by the teacher and then orally spelled by the pupils, 356 errors; words written on the board by the teacher and then pronounced in loud tones by the pupils, 589 errors; the same, pronounced in low tones, 642 errors; the same, with the mouth firmly closed, 763 errors; words pronounced by the teacher and written in the air by the pupils, 772 errors; the words pronounced by the teacher and repeated in loud tones by pupils, 1,213 errors; the same, repeated in low tones, 1,801 errors; the same with closed mouth, 1,902 errors.

A study of the errors leads one to conclude (1) that merely hearing words pronounced is the least effective way of learning to spell; (2) that exposing the word-form to the eye reduces the number of errors; (3) that seeing the word-form and copying the same produces a minimum of error; (4) that writing in the air reduces the number of errors in both the seen and heard lists of words; and (5) that loud speaking —with one exception—proved more effective than low speaking. Professor Schiller made similar experiments in a Latin class, employing the same method, but substituting the Latin for the German words, and the results agree substantially with those already noted. He reaches three tentative conclusions from the study; (1) necessity of absolutely correct pronunciation of all words used by the teacher; (2) dictation should be less used and copying more generally employed during the early years of school life; (3) more time should be given to writing words in the air.

WILL S. MONROE.

Le rôle social de la Femme. Devoirs. Droits. Education par MME. ANNA LAMPÉRIÈRE. 1 vol. in 12 de la *Bibliothèque de Philosophie contemporaine*, 2 fr. 50 (Félix Alcan, éditeur).

This book does not pretend to be a complete study of the subject, but rather presents some general views which the author thinks should

be opposed to the partisans of 'la compagne féministe.' According to Mme. Lampérière, the function of woman in society should be absolutely different from that of man; she should be his co-laborer, not his competitor; she should be employed as organizer, not as producer; in a word, the social function, *i. e.*, duty, of woman, is to expend herself for society, for the race, as her domestic function is to expend herself for the family.

The identity of the rights of man and woman is rejected. The 'right' of the human being is merely the *right* to the full development of his faculties; but the faculties of woman are other than the faculties of man, though "of equal, if not superior, importance for the harmonious organization of the individual life and the social life."

The supreme right of woman is to be protected.

Starting from these ideas, Mme. Lampérière studies diverse situations of woman, notably *à l' atelier* and in marriage. She concludes by treating of the "education of this educator," which should be "conformable to biologic laws," and sets forth the object and the laws of the *Société d' études féminines*, created precisely with such education in view.

The Students' Life of Jesus, by GEORGE HALLEY GILBERT, Ph. D., D. D. The Macmillan Company, 1898. pp. 412.

This book aims to present succinctly and accurately the facts of the objective life of Jesus. No attempt is made to discuss in detail the teaching of Jesus; and the subjective side of his life is considered only as it is revealed in the Gospels. The book is in no sense interpretative. The author adheres pretty rigorously to his purpose of stating "the facts as directly and clearly as possible."

The Introduction, of about eighty pages, is devoted to establishing the historicity and authenticity of his sources, which are the Synoptic Gospels, the fourth Gospel, and the other New Testament writings, containing references to the subject. The author states the problem clearly in each case, and carries on the discussion with thorough candor; but his apologetic attitude leads him at times to lean rather strongly upon the argument from ignorance.

The rest of the book presents schematically the outline of the life, constructed from the aforesaid sources. The work is done critically, giving evidence of ample technical scholarship.

Though the author distinctly disavows any intention of adding any interest to the work not inherent in the facts, one cannot help feeling that the value of the book would have been enhanced by a slight infusion of warmth and color in the disposition of the facts.

W. S. S.

Biomechanik, von DR. ERNST MEHNERT. Privatdocent an der Universität Strassburg. Jena, 1898. pp. 177.

This is a philosophical discussion of the principles of organogenesis. Although the great biogenetic law that the individual recapitulates the stages of the development of the species to which it belongs is true in a large sense, the order in which it has developed does not follow their phyletic age, but is subject to much relative change. The heart, for instance, in the individual develops before the blood vessels, but this reverses the phylogenetic order. The walls of the large vessels develop before the blood corpuscles, while the converse was true in the development of the species. Ontogenetic age in all such cases is an index only of the intensity of kenogenetic energy. Retarded development of an organ on the other hand is an indication of regressivity, and Mehnert has collected much evidence of these cases, showing that abbreviation and retardation of different organs of a

creature, which is their bearer, are ontogenetic processes that are constantly operative. The latter may affect the date of the first appearance of an organ, the differentiation of its tissues among each other, or the entire processes of growth of a part or all of them. Organs are progressive according to the degree of their vitality. The rapidity of the growth of a part is directly as the degree of development acquired by the phyletic process. Each organ also has its own growth center more closely connected with and dependent on the organism of the series from which it has descended than it is upon those structurally or functionally near it or the organ of which it is a part. In other words of all its determinants, those that are inherited are the most important. This is especially true of periods of sudden, explosive growth functions, the interconnection of organs and relation to the environment, and all other individual or epigenetic factors are real and important, but subordinate determinants, so that embryological growth is purest.

It may be further assumed that ripe determinants and a directive programme of energy develop more than those that are immature. The eozoon or paleoatavistic bases of heredity are the formative principles of fundamental organs. These bases condition all others and are constant. The neoatavistic factors on the other hand are the intensity and rapidity of development due to later and more individual influences upon heredity. The earlier part of the life of an animal is more established and more conformable to Weismannism, while the latter part of each individual life is more characterized by the evolution of acquired qualities. Lower animal, especially aquatic forms, that have been subjected to unfavorable conditions, produce young before they are mature or full grown; and these young then tend to stop in their own development at the stage where their parents were when they were produced. Growth might almost be defined as getting loaded up with inherited qualities. Although even epigenetic cells developed under the influence of function may be short lived, still assuming the monophyletic origin of animal life, and also assuming that maturity and death are longer delayed as we ascend the scale of being, more and more weight must be assigned to the later acquired than to the earlier and more stable qualities.

Basal and lapidary as is the biogenetic law, the work of Appel, Keibel, Mehnert, and many others have demonstrated that the exceptions to it are numerous and important. Each higher animal is composed of organs phyletically old and new, and the order of their development may be greatly changed. So great is this "heterochrony" that it may be said in general that the time at which an organ appears is dependent upon the time when it is needed for use, and organs decay as their functions cease. Every animal is, therefore, a mixture of high and low qualities. In many respects many of the lower animals excel man. The generalization here important is that by youthful parents heredity is more confined to older and lower qualities, so that those who attain sexual maturity early do not advance the phyletic series. Species and individuals on the other hand that attain propogative power late make for progress of the stock, because they had not only the wealth of heredity in its completeness, but contribute individual additions, infinitesimal though they may be. Early marriages, therefore, tend to the decay of culture and civilization, and all conditions that make for its "neotenia" are retrogressive, and each generation must reacquire everything anew because parents transmit nothing not transmittsd to them. Conversely, if we follow Mehnert, hyperheredity due to long delay of propogation may be a factor for accounting for the overgrowth of the horns of certain

stags, some of the monsters of the geologic past, and other hypertrophied organs of individual species and functions, even those of genius.

Die Psychosen des Pubertätsalters, von WALTER WILLE. Leipzig u. Wien, 1898. pp. 218.

We have here a careful description of 135 cases of psychic diseases during pubescence, which the author places between 14 and 23, which he has observed during the last fifteen years at the Insane Asylum of Basle. He concludes that there is no specific pubertal insanity, but that puberty gives a peculiar character to their psychoses, all of which may occur at this age. Atypic and mixed phases are unusually frequent. The most common hebephrenic traits are frequent and causeless changes of moods, a certain superficialty that prompts stupid jests in the midst of lamentations; expressions of world pain during the jolliest hours; sudden changes of thought form with the most bizarre construction of sentences; extravagance, talkativeness, echolalia; impulsiveness in action; a theatrical reference to spectators and other degenerative traits play the leading role here. Contradictions are frequent, and delusions of greatness and a sense of exaltation alternate with the most depressive unworthiness. Moreau specifies sudden changes from sadness to gaiety; spells of unusual activity; extreme confidence often combined with chorea and catalepsy. Regis thinks pubertal insanity, more often moral, shows itself in morbid acts and impulses rather than in the intellectual sphere. Savage says psychic abnormalities are like those of early childhood, only more expressed, and that all its many phases tend to issue in weakmindedness. At no time is dysmenorrhea so liable to intellectual disturbance. Blanford thinks violence more common than delusion and that St. Vitus Dance is characteristic. Trowbridge distinguishes between short duration and true psychoses, the latter being usually incurable. In all, periodicity with lucid intervals is common. Moral perversions of boys are prone to take the form of cruelty or crime, while girls are more liable to shameless and erotic perversity; while egotism and self satisfaction are common to both sexes.

Névroses et Idées Fixes, par PROF. F. RAYMOND et DR. PIERRE JANET. F. Alcan, Paris, 1898. Vol. I, pp. 492; Vol. II, pp. 559.

The first of these two heavy volumes, with sixty-eight cuts, is devoted to experimental studies on disturbances of will, attention, memory, emotion and fixed ideas; and the second, with ninety-seven cuts, describes clinical cases and gives suggestions as to treatment. The copious analytical index at the end permits ready reference to all the rich material. Few will perhaps agree with the somewhat extreme standpoint of the author, which describes so many and varied affectations as traceable directly and indirectly to fixed ideas, but it must be admitted that the cases tend to favor the views of the close association between mental and nervous disturbances. The strong point of the work is the interpretation of individual cases. The writer is fully alive to the partial truths that may be contained in the current notions of mental healing. Such topics as confusion, aboulia, emotive delirium, impulsive obsession, somnambulism, chorea, tics, visceral spasms, contractures, allochiria, subconscious hallucinations, hysterical hemianopsia, insomnia, due to fixed ideas and possession, are illustrated, and explanations of very suggestive, if not always conclusive, character, are given.

The Passing of Plato, by O. P. JENKINS. Stanford University Press, 1897. pp. 23.

Here is a Professor of Physiology in the Leland Stanford, Jr., Uni-

versity, who notes the fact that the Greeks originally were sympathetic lovers of nature, till Socrates and Plato, who, "with the purest and best of motives, unconsciously did the race a disservice that became a bar to progress for the ages to follow." The mind can make any hypothesis so there was no trouble to attain any required definitions, "and to defend the whole of these it was necessary to do away with the rest of the universe." These "innocent diversions of Plato," were followed by Aristotle, to whom "mental flights were more attractive than his studies of bugs and fishes." Then follow many other systems evolved from the "lazy philosophy of Plato," but pure thinking, which spread over the world like cobwebs over the lawn on a summer's day, all inspired by Plato. Despite many hopeful signs, these conceptions and methods hang like the old man of the sea upon the neck of the present. Now science is changing all this.

Any well trained student in the history of philosophy will recognize the partial truth of the above, and if he has read Lange's Positivism vs. Idealism, he may detect a similar spirit here, but the author's extreme onesidedness; the surprising lack of historical perspective; his failure to recognize one of the axioms of evolution as applied to man; to say nothing of the fact that Plato was never so much studied as to-day, and that by men as much in sympathy with physiological and biological sciences as himself, altogether make this a very strange note to be sounding at a university commencement.

Moderne Nervosität und ihre Vererbung, von CH. FÉRÉ. Berlin, 1898. pp. 284.

The influence of heredity upon the origin of mental and nervous diseases are—this assumes that there is no nervous disease not connected with anatomical change, and the author undertakes to apply the general laws of biology in this field to pathology. Many diseases and malformations are considered, and even epilepsy and hysteria, it is assumed, must have a physical and transmissible basis. To establish his thesis, the author at the outset makes very material qualifications of the extreme views of Weismann and his followers; lays considerable stress upon the mutability of nervous diseases, especially these transmitted from one generation to the next; and undertakes in some respects to suggest morbid equivalents. He believes that all degenerative tendencies can be successfully combated, provided there is a fit hygiene of propagation which consists mainly in systematic rest beforehand and the most favorable nutritive conditions. The author's reportory of casualistic material is large, and twenty interesting cuts of inherited abnormalities and deformities are given.

Archives of Neurology and Psychopathology. Vol. I, Nos. 1 and 2. 1898.

This new archive is most sumptuously bound and printed, and is to be published in four annual numbers per volume, price, $3 a year. It is to be published under the auspices of the New York State Hospital and the Pathological Institute, by permission of the State Commission in Lunacy. It is to be edited for the former by Drs. G. A. Blumer, C. W. Pilgrim and S. H. Talcott; and for the latter by Drs. Ira van Gieson, Boris Sidis and H. B. Deady. The longest and most important article in the present number is entitled, "The Correlation of Sciences in the Investigation of Nervous and Mental Diseases," by Ira van Gieson, which occupies about 235 pages. A briefer preliminary communication by Van Gieson and Sidis on "Neuron Energy and its Psychomotor Manifestations," makes up the entire number. The archives will contain studies on abnormal mental life and their neural concomitants based on psychology, psychopathology, experimental

physiology and pathology, cellular biology, pathological anatomy, comparative neurology, physiological chemistry, anthropology and bacteriology.

Annual and Analytical Encyclopædia of Practical Medicine, by CHARLES E. DE M. SAJOUS, M. D., and 100 associates assisted by corresponding editors, collaborators, and correspondence. Illustrated by chromolithographs, engravings and maps. F. A. Davis Co., Philadelphia, New York and Chicago, 1899. Vol. II, pp. 607.

The two volumes already issued come down to and include diphtheria. Most of the sections in the entire work are prepared under the immediate supervision of the editor, and are submitted to members of the assistant staff for revision and correction. Each author can change, erase and add. This second volume inaugurates the plan of work as regards elaboration. Some of the best articles in the present volume of interest to psychologists are on deaf-mutism, catalepsy and cocainomania.

The volumes thus far published are of very attractive appearance, printed in large clear type on two column pages, and tastefully and conveniently bound, and what is perhaps best of all in most cases bring down the literature of the more important subjects to the present year. Such a work was greatly needed in practical medicine, and the high character of the authors, as well as the work which has thus far appeared, is sufficient to stamp the encyclopædia as an honor to American scholarship, a necessity for practical physicians and a convenience, not to say a luxury, for psychologists.

Foot-notes to Evolution, Series of Popular Addresses on the Evolution of Life, by DAVID STARR JORDAN, Ph. D., President Leland Stanford, Jr., University, with supplementary addresses by Professors E. G. Conklin, F. M. MacFarland, J. P. Smith. Appleton and Co., N. Y., 1898. pp. 392.

These papers on organic evolution were originally given as oral lectures before University Extension Societies in California, and some have already appeared in the Arena and Popular Science Monthly. It is not intended as a text-book on evolution, although most of its phases are touched on, partly because the different topics are very unequally treated. President Jordan's papers are entitled—the kinship of life; evolution, what it is and what it is not; the elements of organic evolution; the heredity of Richard Roe; distribution of species; latitude and vertebræ; the evolution of mind; degeneration; heredity insufficiency; the woman of evolution and the woman of pessimism; the stability of truth; the struggle of realities. There are twenty-eight illustrations and five full page plates. The topics are treated in a very lucid and popular way, and the book marks an important addition to the illustrations and demonstrations of the development theory.

The Gospel According to Darwin, by WOODS HUTCHINSON. Chicago, 1898. pp. 241.

This book is an effort to glance at some of the influences affecting human hope and happiness from the evolutionary standpoint, and to show how this attitude has a broad and a secure basis for courage and happiness in the present and for hope in the future that the message of Darwin is really the gospel of good, and that the natural is as wonderful as the supernatural, so that we need not longer limit our worship to the mysterious. Darwinism, as the author conceives it, has a wonderful power to broaden and deepen religious interest in the spirit of worship. The chapters are entitled—the fifth gospel, the

omnipotence of good, the holiness of instinct, the beauty of death, life eternal, love as a factor in evolution, courage the first virtue, strength of beauty, the benefits of over population, the duty and glory of reproduction and the economics of prostitution, the value of pain, lebensulst. The author is eloquent and poetic, and in many respects suggests Drummond, but has less sympathy with conservatism.

Les Pensées de Tolstoï, d'après les Textes Russes, par OSSIP-LOURIÈ. F. Alcan, Paris, 1898. pp. 179.

In this little book with a preface dedicated to Ribot, the writer selects pregnant quotations from Tolstoï, and groups them under the heads of life, man, society, religion, power, patriotism, militarism, riches, work, happiness, science, art, education, feminism, love, marriage, the good, evil, truth, the ideal, and death. A complete list of Tolstoï's works are appended, and also a list of works in different countries that have been influenced by Tolstoï. Each quotation is numbered for cross reference to sources.

La Philosophie de Charles Secrétan, par F. PILLON. F. Alcan, Paris, 1898. pp. 197.

Secrétan is known as the philosopher of liberty, from the title of his chief work which treats of liberty, human and divine, in a special connection with the three great Christian dogmas of creation, fall and redemption. Liberty and the philosophy of Christianity are for him synonomous terms. The material of the books falls into the three natural chapters of metaphysics, morals and critical observations.

Dynamic Idealism, by A. H. LLOYD, Ph. D. Chicago, 1898. pp. 248.

This is an elementary course in metaphysics of psychology first entered upon in lectures before the students in the University of Michigan. Psychology without metaphysics is useless if not absurd, and real psychology is metaphysics. The author has been more interested in the relation of the psychological theory to dualism or monoism than to any of its mere external details. Only metaphysical principles can make any process really complete. The first duty of psychology is to give the distinct doctrine of the soul. The organs of the soul are after all the true definition of it. The author discusses in the first part, the world and things including change, organism, body, outer world; secondly, ideas not as forms but as forces; consciousness as interest, etc.; and thirdly the world of acts, the will, the living ideal. The appendix contains a study of immortality in outline.

A Treatise on Aphasia and other Speech Defects, by H. CHARLTON BASTIAN. London, 1898. pp. 366.

Five of the seventeen chapters of this work are reproductions with a few additions from the author's Lumleian lectures, and treats the subject in a more complete way than has hitherto been attempted. Theoretical opinions are in general avoided and very many typical cases, some of which are from the author's own observation, are presented, especially where the necropsy was carefully made. Speculative classifications are to a great extent omitted, and some attempt is made to simplify the nomenclature. The relation between thought and language, classification of speech defects and those of writing, due to structural or functional degradation, amnesia, etiology, and modes of recovery, amimia, prognosis and treatment are perhaps the studies most fully treated. This work in general, comprehensive as it is, well illustrates the fact that we really know far more about sensory than we do about motor aphasia, and quickens the hope that the long promised and long delayed work of Dejerine will soon appear.

Histoire de la Sépulture et des Funérailles dans l'Ancienne Egypte, par E. AMÉLINEAU. Paris, 1896. (Annales du Musée Guimet) pp. 336 and 345.

These volumes, the twenty-eighth and twenty-ninth of the Museum, consist of the history of sepulture and funeral rites in ancient Egypt, and are illustrated by 112 wood cuts. The profound influence of the form of Egyptian belief in immortality dominated art, architecture, etc., and no country is fuller of monuments of this belief than Egypt. The monuments, tombs, etc., are described historically, and with great detail; although all the chapters are exceedingly objective, the author does not hesitate to pause for interpretations sufficient to define his standpoint for the reader.

Affirmations, by HAVELOCK ELLIS. London, 1898. pp. 248.

"How happy the world might be if there was no literature but the Bible, if Augustine, Aquinas, Calvin, and thousands of smaller men, had not danced upon it so long, stamping every page into mire." The author has been all his life casting away knowledge gained from books aud literature and coming toward that haven of knowledge where a child is king. Very different from this is the literature of life, and the author uses Nietzsche, Casanova, Zola, Huysmann, and St. Francis, essays on whom make up the book, as stalking horses to creep up more closely to the life his soul loves so well. He has a special predilection for questionable themes and deems it useless to discuss others, although certainty is the end of all. He desires to settle a few things, clean out the Augean stables, and recall the simple, eternal facts of existence. Yet for every man his own affirmations are always the best. The essays are written in a sprightly style, and while they presuppose some things about the author treated, make the best of all introductions to them.

The Problems of Philosophy, by JOHN G. HIBBEN, Ph. D., Stuart Professor of Logic, Princeton University. New York, 1898. pp. 203.

As an introduction to the study of philosophy, the author's design is to indicate between points at issue on controverted questions without details or exhaustive criticism. It is assumed that the student who is beginning the history of philosophy will find himself at a loss to understand the relation between earlier and later periods, and will lack proper perspective to appreciate the drift of opinions. After the plea for philosophy, the successive chapters discuss the problem of ontology, cosmology, psychology, epistemology, logic, ethics, political science and æsthetics. The standpoint is that of idealism, the method lucid, and the book attractively printed and bound, and conveniently indexed.

The Skin Considered as an Organ of Sensation, by J. S. LEMON, Ph. D. Gardner, Mass., 1899. pp. 56.

Dr. Lemon, a former pupil of Clark, here treats the genesis of touch and of the skin and nervous system; the resumès of different theories about these topics and central localization; analyses of different skin senses and the recent experimental investigation upon them; discusses illusions, etc. The strong point of the paper is perhaps the author's study of the earlier history and literature of the subject. From one to half a dozen writings by 128 authors are appended.

The Doctrine of Energy. The Theory of Reality. By B. L. L. London, 1898. pp. 108.

The author has previously published essays entitled, "Matter and Energy," and "Are There Two Real Things in the Physical Universe?"

His theory was that the present conception of energy supersedes the idea of matter and by itself explains all the real elements in all physical phenomena. This view is now presented from the metaphysical standpoint. What we call volition in all its forms is dependent upon the unseen energetic substratum "whose transmutations to volition merely initiates and works, and it is natural to suppose that all the motions and transmutations of this energy are similarly originated by the supreme intelligence or will." Intelligence and this unseen basis on which all its actions are exerted and out of which its perceptions are derived, are the two real entities which reason must predicate. Sense phenomena result from their interaction and are a mere quality of that phenomenal world which contains neither of the real entities.

Der Körper des Menschen, von DR. A. BRASS. Wernigerode a. H. 1898.

This is the first installment of the first of three volumes, entitled development history, which is to contain an atlas with many illustrations in color. All is to be written in a way to represent the present state of science and to be easily intelligible by all. This first section of sixty-two pages, four of which are devoted to wood cuts and three to colored engravings, treats of sex and reproduction. Technical terms are avoided when possible, and when not, they are very briefly explained, and the style is certainly very simple, and many facts are stated as though written from a large fund of information.

Guesses at the Riddle of Existence and other Essays on Kindred Subjects, by GOLDWIN SMITH. The Macmillan Co., New York, 1898. pp. 244.

Three of these five papers have appeared in the North American Review or Forum, and all are written according to the view that amidst all the religious doubts and perplexities of the present are that our salvation can only be found in uncompromising allegiance to the truth. The spirit is not agnosticism but hopeful inquiry; despite the collapse of proofs of a supreme being, our hearts affirm him. The church and the Old Testament; the miraculous element in Christianity; morality and theism are some of the other topics treated.

Spiritual Consciousness, by FRANK H. SPRAGUE. Wollaston, Mass., 1898. pp. 238.

Men have been fed on the dry husks of materialism until they cry out for something better. Spiritualism, Christian Science, spiritual healing, theosophy mark an earnest desire to reach the inmost kernel of life. This and the tendency of the age toward unity are everywhere noted, and in a few points are sought. These tendencies are discussed in chapters entitled: what is truth; realization of ideals through right thinking; the outer and inner world; consciousness; Christianity; growth of society; the problem of evil; spiritual basis of love; manifestations of the spiritual principle; music, art and nature. There is almost no reference to literature, and the earnestness and seriousness of the author are impressed on every page.

Destinée de l'Homme, par M. l'ABBÉ C. PIAT. Paris, 1898. pp. 244.

The primary certainties in the world are psychological, that is, spiritual, and their quality and intensity are fundamental. The unknowable is especially found in our passions. Eternity of the ideas does not imply that of human thought, and we cannot reason from their nature to the quality of the soul. Our theory of impersonal reasons cannot be proven. Liberty cannot solve the problems of the unconscious limits and bases of our mental being. Thought and nerve action

are a mysterious solidarity. The fundamental beliefs of the world are: purpose, thought, love, action. Materialism has no possible proof, spiritualism rests on the solid basis of teleology and must grow with time.

Ueber die sexuellen Ursachen der Neurosthenie und Angstneurose, von DR. FELIX GATTEL. Berlin, 1898. pp. 68.

The author has collected and tabulated 100 cases from which he draws the conclusion that the neuroses of anxiety always tend to occur wherever there is excessive retention of libido; while pure neurathenia occurs only as a result of masturbation. In none of the 100 cases he collects was the sexual life normal.

Gerichtliche Psychopathologie, von DR. ANTON DELBRUCK. Leipzig, 1897. pp. 224.

The author is a specialist in the Insane Asylum of Burgholzli and privätdocent at Zurich, a pupil of Forel, and addresses his brief text-book to students, physicians and jurists. After discussing the nature or legal responsibility, methods of investigation and the qualifications of experts, the writer takes up the leading types of mental diseases, including poisoning, neuroses, including epilepsy, histeria, constitutional disturbances and arrested development. Perhaps the topics best treated are: imperative ideas, moral insanity, morbid impulses, simulation. The clinical material occupies but very little space; a digest of laws and a copious index are appended.

Problèmes d'Esthétique et de Morale, par C. R. C. HERCKENRATH. F. Alcan, Paris, 1898. pp. 163.

The writer is a professor in a Holland Lycée, and presents briefly his views on beauty, sublimity, tragedy, comedy, laughter, morality and its evolution, the moral sentiments and the relations of æsthetics and social science.

Christentum's Ende, by FRIEDRICH NONNEMANN. Munden, 1898. pp. 145.

Lest the startling title of this book should give alarm, it may be said at the outset that it is introduced by a dream, and is written novel-wise and most ecstatically. Christianity ends in Jesus Christ, to whom be thanks, praise and love forever.

Die Entwickelung der Religiosität und das Werk der Religion, von DR. E. REICH. Zweiter Band.

Das Werk der Religion und der Kampf gegen das Verhängniss. 1898. Zurich. pp. 426.

The author here writes in his characteristic prolix but entertaining style with voluminous and apt quotations on the categories and essence of time and eternity; the practice of religion by means of hygiene and education; morals and culture. The agents by which the warfare is waged against fate are: society, humor, temperament, energy, feeling, character, genius, religion; and fate is found in false societies of social organization, politics, insanity, alcoholism, nervousness, gambling, other forms of evil and sin, and degeneration generally. The book should be regarded, not as a treatise that adds essentially to its topic, but as an interesting and stimulating collection of opinions with sensible and interesting comments from many fields, especially that of anthropology, in which the author's learning is so extensive.

The Book of the Master, by W. MARSHAM ADAMS. Putnam Sons, New York. pp. 204.

The author describes the Egyptian gospel of the light born of a virgin

mother. It traces a clue afforded by the comparison of the secret passages and chambers in the great pyramid with those described in the second papyrus, familiarly known as the "Book of the Dead," but originally entitled "The Book of the Master of the Secret House." Both reproduce the same religion, one in stone, the other in words. He finds no symbolism in either, but undertakes to express in clear form, where all may follow, an outline of the deeply veiled doctrines of the earliest recorded religions, which certainly, as he interprets it, was full of majesty and beauty. He describes the prevalent ideas of the resurrection in Egypt; the religion and light; the festivals of the sun and moon; the temples of the virgin mothers; the entrance of light and instruction; the initiation of the postulant; the illumination in truth; the master of the secret. The book contains some thirty illustrations.

Les Croyances de Demain, par LUCIEN ARRÉAT. F. Alcan, Paris, 1898. pp. 178.

Despite its ambitious title, the pretensions of this booklet are modest. The author does not attempt to define the faith of the future, but only to hint at a few of its features. At best the system of philosophy is only a pocket mirror to see nature in; but our author wishes to be naïve and ignore all philosophies. His standpoint is that of the parliament of religions at the Chicago Exposition. His view is, on the whole, optimistic. The certitudes which make the first part of his book are that religion will enlarge its horizon, extend its sphere of activity, but his sentiment will always guide man. Justice is written in the very mechanics of nature, and moral evolution is certain; and so is both the individual and historic sanction. The second part, or conjectures, discusses the cosmos, the soul, God, science and education. Religions will be less exclusive; their harmony will be more emphasized and their differences less; nature will be seen to be neither cruel nor beneficent; and the highest human service consists in turning its energy toward the improvement of the social life. The doctrine of personal immortality will grow dim; that of a personal God may be superseded by the definition of the ideal sum of phenomena; philosophy will take the place to some extent of theological dogmas; international barriers will be broken down; risks minimized; the feeble eliminated; and peace will reign. Life is what we make it, and especially what we wish to make it. We must, therefore, believe in the good and have energy to bring it to pass.

État Actuel de la Question de l'Acæboïsme Nerveux, par RENÈ DEYBER. Paris, 1898. pp. 127.

The conclusions of this doctor's thesis are that protoplasmic movement plays an important part in cell action generally, and that nerve cells differ from others in having peculiar means of prolongation and retraction, suggested by their very structure. Visual cells of the retina and motor functions although their plasticity may be less than those of the pyramidal cells in the brain. This amœboidism or dentritic prolongation of neurons exhibit almost every possible transition from temporary pseudopodia to vibratory hairs. In those organs where the existence of centrifugal fibres is demonstrated, central cells command movements of cells of less importance, and chromoblasts. These may be called in a sense veritable nervi-nervorum.

History of the Principle of Sufficient Reason, by WILBUR URBAN, Ph. D., Reader in Philosophy, Princeton University. Thesis, February, 1898. pp. 88.

After stating the problem, the author characterizes pre-Leibnitzian

thinking, and then the philosophical motives of Leibnitz; Kant's idea of sufficient reason as the basal principle of metaphysics; the struggle between Trendelenburg's logic and Herbart's metaphysical motives; and describes the Sigwart and Wundt view of sufficient reason as the base of logic.

Psychologie der Veränderungsauffassung, von L. Wm. Stern. Breslau, 1898. pp. 264.

The author is a privätdocent in the University of Breslau, and attempts to answer the question, how change can be known, or what are the psychic roots of this category, and what are its various modes of operation in the field of the different senses? The best part of the work is the second, which gives an excellent presentation of the technique and methods of experimental determinations of minimal changes to show the psychic excitability for them and to develop their laws. Incidentally the effects of signals, fatigue, surprise and expectation, optimal time, etc., are discussed, and on the whole the topic is treated in a way so stimulating and suggestive that the author's conclusions will, we think, generally commend themselves to experimenters.

Essai d'une Philosophie Nouvelle, par Léonce Ribert. F. Alcan, Paris, 1898. pp. 562.

The plan and purpose of this volume is unique; although the author only claims the virtues of the diligent compiler and popularizer, he undertakes to present the general conclusions of cosmogony and the nebular theory, celestial mechanics, geology, laws of heat, chemical affinity, light, electricity, paleontology, animal life, savage and barbarous man, and to draw the general results of Greece, Rome, the Middle Ages, to criticise current systems, and to draw from it all metaphysical and moral conclusions. He believes the idealism of the future will rest on the solid basis of fact, and the new philosophy owes its origin for him to new conclusions of the special sciences about nature. It is thoroughly ideal and metaphysical, but not positivistic.

L'Etre Subconscient, par Dr. E. Gyel. F. Alcan, Paris, 1899. pp. 191.

Dr. Gyel at first describes obscure facts in normal and abnormal psychology. The latter, treated at considerable length, involves hypnotism, telepathy and psycho neuroses generally, with attempts to explain all the established phenomena. The three laws that he draws from it all are the evolutive laws of progress, effort and solidarity, and thus reaches a new explanation of evil, of morals and the social question. He believes thus he can reach the philosophy of the future based on positivistic knowledge and guided by deductions in strict conformity with the scientific spirit.

Jalresberight über die Leistungen und Fortschritte auf dem Gebiet der Neurologie und Psychologie. I. Jahrgang. Karger, Berlin, 1898.

This large volume of 1,508 pages in the first resumès the best of its over 3,500 papers on nervous and mental diseases that appeared during the year 1897. Professors Flatan, Jacobson and Mendel, all of Berlin, are the chief editors. Fifty-three names, many of them prominent, are named as collaborators. The range of topics is wide, including therapeutics and criminal anthropology. Besides a general index, outlining its plan of arrangement, there are two full indexes, one of topics and the other of authors' names, at the end. The difficulties of such an undertaking, especially for the first year, are immense, and nothing but German industry could cope with them. All psycholo-

gists, as well as neurologists and alienists, will most heartily welcome this as a boon of the highest practical value for their work. In few topics is its really valuable literature more widely scattered in many languages and in publications of more various kinds. As far as we have examined this great work, we find nothing in it not worthy of hearty commendation, and all interested will share our earnest hope that the yearbook will meet the encouragement it so well merits and be continued.

With Pillon's Année Philosophique now in its ninth year; the Année Psychologique of Binet and Henri; the Année Biologique of Delage, the student of psychology, in the large sense of that word, has aids to his work that are not only valuable, but indispensable.

L'Education des Sentiments, par F. THOMAS. Paris, 1899. pp. 287.

Intellectualism has been the ideal of education, but in the present reaction against its ideals there is a tendency to study and train the sentiments. Pleasure is a guide and aid, and pain makes pleasure more intense and puts us on our guard against many evils. Neurasthenia, which increases pain, is combated by change of work, rest, exercise, country life, rules of hygiene. Fear is educable by judicious exposure to it, anger by restraint, curiosity by rational gratification, etc. The instinct of property, self-esteem, social inclination, friendship, patriotism, sympathy, pity, love of truth, of play, the beautiful and good, are all educable by various means. The book is very interesting and suggestive.

A Study of the Ethical Principles, by JAMES SETH. Chas. Scribner's Sons, New York, 1898. pp. 470.

This third and enlarged edition makes this one of the very best of modern books upon the subject. It is the outcome of years of continuous reflection and teaching in which the author has sought to rethink the entire subject, and to throw some light upon the real course of thought to ancient and modern times. He has particularly striven to recover and in part restate the contributions of the Greeks, especially Aristotle. He prefers to be called an eudæmonist in the original sense of that term. The present edition contains a new chapter on the nature of ethics which explains the more limited view of this field which further reflection has forced upon the writer. In the second part a new chapter on moral progress has been added, and a sketch of literature is appended to each chapter.

Theories of the Will in the History of Philosophy, by ARCHIBALD ALEXANDER. Chas. Scribner's Sons, New York, 1898. pp. 357.

The writer, formally Professor of Philosophy in Columbia College, here attempts the concise account of the theory of the will from the earliest Greek thought down to about the middle of the present century. He modestly disclaims the title of history because he has only included the theories of the more important philosophers. He holds that historical treatment is indispensable to the proper presentation of the subject, and closes his view with the theory of Lötze with an intimation that it will be continued later. Theory, the author thinks, has tended to make us regard no psychical states as self explanatory, but rather as a result of antecedents or as compounds of simpler elements. This is seen in the tendency to seek the germs of adult psychic states in the infant mind, and even in animals, as well as to take the brain into account. These facts inspire the hope that the genesis of conscious volition may be explained more clearly. Will is considered in the Socratic period, in stoic and epicurian theories, in Christian theology, in British philosophy from Bacon to Reid, on the continent from Descartes to Leibnitz, and in Germany from Kant to Lötze.

The Foundations of Zoölogy, by WILLIAM K. BROOKS. The Macmillan Co., New York, 1899. pp. 339.

This book, which has been for some time awaited with interest, is the fifth in the Columbia University Biological Series, and is rather singularly dedicated to "Hobart College where I learned to study, and I hope to profit by but not blindly follow the writings of that great thinker on the principles of science, George Berkeley." The titles of the twelve lectures, which compose the book, will give the best idea of its wide scope and great importance—Huxley and the problem of the naturalist; nature and nurture; LaMarck; migration in its bearing on LaMarckism; zoölogy and the philosophy of evolution; a note on the views of Galton and Weismann on inheritance; Darwin and the origin of species; natural selection and the antiquity of life; natural selection and natural theology; Paley and the argument from contrivance; the mechanism of nature; Louis Agassiz and George Berkeley.

The Use of Color in the Verse of the English Romantic Poets, by ALICE EDWARDS PRATT. Chicago, 1898. pp. 118.

The use which has been made of color and color terms by Pope, Thomson, Gray, Goldsmith, Cowper, Scott, Coleridge, Wordsworth, Byron, Shelley and Keats, required a careful reading of the poets, and the cataloguing of each usage of color. The results for each poet are classified, first by color groups, and second as distribution among various fields of interest. Nine colors or color groups are used, and twelve fields of interest: viz.—man, dress, manufactured articles, animals, minerals, flowers and fruits, sky, land, waters, miscellaneous objects, color as color, and abstractions. Four hundred thousand lines of verse were read, and two interesting charts are appended, one on color words applied to human eyes, hair, skin; and the second, on those applied to sky, cloud, air, vegetation, hills and deep water. Interest in color culminated in two periods—with Goldsmith representing the lowest stage between them. Scott, Wordsworth and Shelley are near the apex of the first, and the romanticists, after Tennyson, of the second maximal use.

The Sexual Instinct and its Morbid Manifestations from the Double Standpoint of Jurisprudence and Psychiatry, by DR. B. TARNOWSKY, Translated by W. C. Costello and Alfred Allinson. Paris, 1898. pp. 239.

This important work, which first appeared in a briefer form in Russian, in 1885, is here at last translated with a considerable number of fresh observations, which, however, do not especially modify the author's theory. He adopts as the motto of his book the sentence of Havelock Ellis to the effect that now that the problems of religion and labor have been more or less either settled or placed on a practical basis, the question of sex and the race, which rests on it, now becomes the chief problem for coming generations to solve. "Sex lies at the root of life, and we can never learn to reverence life until we know how to understand sex." The book is very attractively printed and bound and contains a frontispiece of the author.

A Plea for Polygamy. Paris, 1898. pp. 280.

This anonymous book, with an edition strictly limited to 300 numbers, is a serious and earnest argument, based chiefly on anthropological rather than biological grounds, that polygamy is practical and in some respects and under certain circumstances not only justifiable, but highly advisable. The author thinks it would prevent a social evil; that monogamy prevents and retards marriage, which is not only a

duty, but an inalienable right for all who wish it, etc. The author's view is extreme, and his accusations against monogamy are bitter; his list of great men in the past who have been open or covert polygamists; his analysis of love and the primary laws of marriage exhibit little scholarship, strong prejudice, and a propensity for extreme views.

Psychology of Sex, by HAVELOCK ELLIS. Vol. I. Sexual Inversion. University Press, London, 1897. pp. 204.

This first volume is largely a translation of the author's work published a year earlier in Germany. From the latter work, however, some matter has been omitted, but more has been added. As a youth, living in an Australian city, where the ways of life were seen, Mr. Ellis resolved, twenty years ago, that one main part of his life work should be to make clear the problems of sex. He has a deep sense of the evils of ignorance, and suppression of efforts that can never be suppressed, but may easily be perverted; and pleads in a preface the cause of sincerity against that of reticence. In the days of the great treatise of Sanchez, the church dealt faithfully with this subject, now it ignores and slights it. A later volume is to be devoted to normal phenomena in this field.

The Determination of Sex, by DR. LEOPOLD SCHENCK. The Werner Co., Chicago, Akron and New York, 1898. pp. 222.

This is called an authorized translation, but the name of no translator is given, neither are we informed where the original papers of the author are found. The style of the translation is exceedingly unsatisfactory, leaving the reader often in great doubt as just what the sentences mean. The general conclusion, however, is plain enough, and is, as is well-known, that sex is determined in the very early months of pregnancy by the presence or absence of sugar in the urine, which the author's extremely delicate phenylhydrazine test detects even the faintest trace of. If the diet during this period can be so determined that no sugar is given off, a male child is the result. If it is thus excreted, a female child is produced. The very wide range, however, of variation in this habit requires a very careful individual study, and the preliminary study of dieting must precede impregnation for some weeks or months.

Die Geschlechts-Bestimmung des Werdenden Menschen, von KARL VON HAGEN. Berlin, S. W., 1898. pp. 60.

This brochure attempts to sum up what we knew and what we know on the predetermination of sex. Assuming the general correctness of Schenck's theory, of which the author gives a somewhat popular statement, he attempts to draw certain practical diathetic rules concerning marriage, food and regimen; supplements the theory with a number of very bold conjectures of his own; and introduces a number of striking psychological conceptions.

Sex Worship: An Exposition of the Phallic Origin of Religion, by CLIFFORD HOWARD. Washington, D. C., 1897. pp. 166.

The author makes sex worship the basis of religion in the world. It was universal and primitive, and has left its mark on, not only all religions, but all languages and institutions. It was inspired by the phenomena of nature, and many of its most formal mysteries were springtime celebrations of the regeneration of life. Now in India there are millions of true Phallic worshippers. Even the highest theologies are its product, and God himself is love. So diverse and changed have been its effects that many really worship at its shrine without knowing it. The author shares what to us is extravagance of

nearly all writers upon this subject, the propensity to see Phallic emblems symbolized everywhere and in everything. His work on the whole is earnest and respectable, but shows few traces of the scholarship really required to treat this subject critically and well.

Psychologie de L'Instinct Sexuel, par LE DR. JOANNY ROUX. Paris, 1899. pp. 96.

This is the best little compend on this great subject that we have seen, and is written with the wide knowledge of the best literature. The first chapter on the basis of sexual need leads up to the conclusion that this takes its rise in every part of the organism, and its exciting cause is similar to that of the desire for food. The second chapter discusses the nervous centres of this function and its relations successively with olfactory, visual, auditory, tactile and gustatory sensations. The third chapter discusses choice, from the lowest animals up to man, with the usual account of the theories of Schopenhauer and Hartmann. The fourth part treats of the higher forms of love, the role of intellectual, moral and emotional qualities, and the evolution of the affectional nature.

Degeneracy: Its Causes, Signs and Results, by Eugene S. Talbot, M. D. London, 1898. pp. 372.

The author is a Fellow of the Chicago Academy of Medicine, and presents here the results of twenty years of labor in a limited medical department of biology. He writes especially for educators and parents, and avoids laying stress on any one cause of degeneracy, nor will he venture to rigidly distinguish abnormality from disease or atavism from arrested development. He considers the stigmata of heredity, consanguineous and neurotic intermarriages, intermixture of races, toxic agents, the school strain, degenerate cranium, nose, face, eye, ear, teeth, and jaw, reversion, mental and moral degeneracy, and illustrates his work with 117 interesting and mostly new cuts. The author is bold, original and suggestive, and his work is a contribution of real and indeed great value, more so on the whole than anything that has yet appeared in this country.

Evolution Individuelle Hérédité, par FELIX LE DANTEC. F. Alcan, Paris, 1898. pp. 306.

This is a theory of quantitative variation, and considers the subject under three general heads: I. The monoplastids, both sissipare and those with so-called cyclic evolution. II. The polyplastids, first from the standpoint of their individual evolution, and second from that of heredity. III. He discusses certain facts and theories connected with heredity such as embryogenic acceleration; Cope's diplogenesis; Delage's theory of actual causes; with a final chapter on teleology.

Beiträge zür Physiologie des Centralnervensystems, von MAX VERWORN. Jena, 1898. pp. 92.

This first part of a more comprehensive work of the above title is not the so-called hypnosis of animals. The author first describes with some detail the phenomena in birds, mammals, reptiles, amphibia, fish and crabs, with the attempted explanation of Circher, Zeemack, Preyer, Huebel and others; and then characterizes the chief phenomena in man with the theory of the biotomic process which he assumes in neurons. The characteristic posture of hypnotized animals he holds is due to a corrective reflex which requires the muscles involved to remain in tonic contraction, and is the same if the cerebrum is removed. It is all simply the inhibition of voluntary activities that we always observe when strong sensory impressions are intense.

A Mechanico-Physiological Theory of Organic Evolution, by CARL VON NÄGELI. Chicago, 1898. pp. 53.

This little hand-book by V. A. Clark, a student in the University of Vermont, working under the direction of F. A. Waugh, is a very careful summary of Nägeli's mechanico-physiological theory of evolution, and will prove a real convenience to students.

The Formal and Material Elements of Kant's Ethics, by WILLIAM M. WASHINGTON. New York, 1898. pp. 67.

This thesis treats the fundamental principles of the metaphysics of morals, the critique of pure practical reason, and the metaphysics of ethics.

The Basis of Early Christian Theism, by LAWRENCE T. COLE. New York, 1898. pp. 60.

The writer first treats the Greek and Roman theistic arguments, then presents the patristic point of view and the patristic use of the theistic argument, and finally eclectic theism, which he advocates.

Der Hypnotismus, von KARL WACHTELBORN. Leipzig, 1898. pp. 98.

Has hypnotism a place in practical medicine? The author pleads that it is not only utterly worthless, but is a dangerous and in fact a poisonous thing. Even if its first effects are good, the reaction is detrimental to body and soul. It may and doubtless has advanced man's knowledge.

Das Hypnotische Hellsch-Experiment, von RUDOLF MÜLLER. Leipzig, 1898. pp. 322.

This pamphlet is only an extract from two volumes of the above title, and the whole is a plea for the recoguition of hypnotism as an important method of scientific psychic investigation.

Die erkenntnifstheoretische Stellung des Psychologen, von RUD. WEINMANN. Leipzig, 1898. pp. 252.

This is at the same time a contribution to the foundation of the realistic mode of thought as the only one possible. The realism here represented is confessedly an hypothesis, but one which admits of the greatest simplicity and correctness of description.

Der Ativismus, von DR. I. H. F. KOHLBRUGGE. Utrecht, 1897. pp. 31.

The conclusions of the first paper is that all so-called atavistic anomalies call forth neutral variations (neutral in relation to future race types) either by change or arrest of development. Arrests are caused by disturbances, mostly casual and unknown, occasioned often by unequal distribution of energy of growth. There is a power of variation about the centre, so that variation is always liable to be progressive or retrogressive. The second article consists very largely of a collection of opinions of various eminent biologists upon the subject.

Die vierte Dimension, von DR. LEOPOLD PICK. Leipzig, 1898. pp. 46.

This writer holds that a surface can be conceived as a section of two bodies. The question whence bodies can be thought to have arisen leads logically to a fourth dimension of space. Length, breadth and thickness do not exhaust the essence of body. We never see body, but only surface. Higher creatures might see the partition of the material and immaterial, inner extension or the fourth dimension, and this really unknown numeral of things, which may be defined as Ausdehnung nach innen. Man stands on the threshold between the third and fourth dimensions.

Religion und Christentum, von PAUL EWALD. Leipzig, 1898. pp. 39.

Christianity is the ideal of all religions, an affirmation of the supersensuous, and based upon an eruption of the supersensuous into earthly life. It is proper, therefore, to speak of its objective basis, and its best definition is communion with God. Christ is its center, and yet throughout it is the true expression of the inner nature and needs of man.

The Repair of Will-Loss, by JOHN M. Taylor, M. D.

In these three lectures, which are abstracted and reprinted from the International Clinics, the writer seeks to illustrate how certain differences arising in puzzling medical situations may be met. He assumes that long protracted ill-health is almost sure to end in misconduct. It is difficult to get hold of those who most need medical aid or reproof. The basis of all treatment is nutritional. Every subject requires very special and detailed study and great personal care.

Early American Philosophers, by ADAM L. JONES. New York, 1898. pp. 80.

This Columbia University thesis presents a concise account of William Brattle, Benjamin Franklin, Cadwalader, Thomas Clapp, and a fuller characterization of the life, education and opinions of Samuel Johnson and Jonathan Edwards.

Psychologische Untersuchungen Über das Lesen auf Experimenteller Grundlage, von BENNO ERDMANN und RAYMOND DODGE. Halle, Max Niemeyer, 1898. pp. 360.

After a brief introductory analysis of the process of reading, the authors résumé the results of previous experimental studies in this field, criticising extensively the work of Cattell, Grashey, Wernicke, and Goldscheider and Müller.

The authors began their experimental study with an investigation of the alternating "reading-pauses" and eye-movements. The eye-movements were observed in a mirror while the subjects (the authors and one other) read familiar or unfamiliar passages from Helmholtz's Optik and Lock's Essay on Human Understanding. The average angular excensions are found to vary, in the different subjects and texts, from 3°45′ to 5° for comparatively unfamiliar passages, from 4°14′ to 5°36′ in familiar passages. They state the number of fixations required in writing, proof-reading, and in reading a foreign language. By telescope observations on reader's eye the first fixation of each line is found to fall within the line, and the last falls still farther within.

Assuming that the results of the measurements of the speed of eye-movements, made by Dodge and others (as described later), are valid for the reading-movement, the authors argue that during $\frac{1}{12}$ to $\frac{23}{24}$ of the reading-time the eye remains fixated, and that, during the movement, recognition of letters or words is impossible.

The extent of the "reading-field" is next studied, first by having subjects describe periphery of points fixated on printed page; second, and mainly, by "experimental isolation of the reading-pauses and fields." The projection apparatus used in exposing reading matter is described at length, as is also the Dodge Chronograph used in connection with it and already described elsewhere.

Wishing to make the length of exposure as nearly that of reader's usual fixation as possible, while still excluding reacting eye-movement during exposure, the authors proceed to determine the eye's reaction-time in the following manner: From a point first fixated the subject moved to a second fixation point 12 mm. distant on the appearance there of a small letter c. Simultaneously with this c a large

letter O was exposed so as to fall just within the blind spot with the eye in first fixation, but becoming visible the instant the eye was moved. The length of the O's exposure necessary to make it visible was taken as measure of eye's reaction-time, subject to a slight correction. The minimum time was shown to be between 188σ and 230σ, the experiments not being extensive enough to determine it more definitely.

The experiment is certainly most cleverly planned. The times given seem rather long, and it is to be hoped that other experiments may assure us of their validity.

Exposures for .1 second of letters and words gave results not very different from those obtained by Cattell and Goldscheider in their shorter exposures. Words were read at greater distances and in shorter exposures than letters, and our authors are thus led to argue strongly against the theory of "Buchstabirend Lesen" even in the modified form in which it seemed to have support in the work of Goldscheider and Müller.

The determining-letter theory of the latter is criticised, and the conditions of the reproduction of the "Wortklangbild" are discussed at length.

The authors then make an exhaustive criticism of the "psychological presuppositions for the derivation of psychic times," and later a special discussion of their derivation for the processes in reading.

The results of the psychometric investigations made at Leipzig by Prof. Cattell are subjected to a merciless dissection, and some of the methods and deductions current in psychometry are given a shaking-up which is interesting, to say the least.

The last two chapters report the results of experiments on adequate sound-reactions to printed letters and to words of various lengths and degrees of familiarity. A careful analysis is made of the psychic components of these reactions, and the relations which they bear to the corresponding processes in actual reading.

In an appendix on "the angular speed of eye-movements," after reviewing the work of Volkmann and of Lamansky, the experiments of Dodge are described.

Dodge used a modification of the Helmholtz-Lamansky method of counting the after-images from light stimuli given at regular intervals during the eye's movement. Movements of 5° required 15σ; 15°, 30σ; 30°, 50σ, nearly twice the times given by Lamansky.

Dodge's clever extraction of apparently valid results from the misused data given in Volkmann's experiments is deserving of notice.

On the whole, this is by far the best and most extensive work thus far on the Physiology and Psychology of Reading. Though it stop short of much more that is essentially important, it treats the subject in some of its most vital parts, and has many good things which cannot be touched upon here. It is to be regretted that the authors have not practiced the American art of condensing, which might well have given us the book's essentials in not more than half its present bulk.

The unity of the work as a treatise on reading would be much enhanced by relegating to the appendix much of the description of apparatus, and by the separate publication of the "criticism of psychic times."

E. B. Huey.

NOTES AND NEWS.

A Study of Taste Dreams.

In a former issue of this JOURNAL (Vol. IX, pp. 413, 414) I gave the results of some experiments on the visual elements of the dreams of my students of psychology in the State Normal School at Westfield, Massachusetts. More recently I have experimented with my students for taste dreams. The conditions imposed by the test required that the mouth be washed out just before retiring, and that a clove be crushed and allowed to remain on the tongue. This was continued for ten successive nights and the details of the remembered dreams written out the morning following. Twenty women fulfilled the conditions of the test and reported a total of 254 dreams.

A strong visual element was reported in 123 of the dreams; a marked auditory element in 17, and a pronounced motor element in 36. Seventeen taste and eight smell dreams were reported. The significant fact in the study is the large proportion of taste and smell dreams. With three of the students cloves were involved—one of "tasting cloves very distinctly," and another of "eating cloves." One dreamed of reciting in school on the importation of cloves from the Molucca Islands. This, she thinks, may have been due to a recent lesson on commercial geography on spices and condiments. Several students reported dreams involving the tasting (and eating) of fruits, the orange being oftenest mentioned. One dreamed of eating nuts and one of eating spiced food. A student who dreamed of tasting wormwood thinks it may have been suggested by a discussion which took place in the psychology class just before the taste experiment was undertaken. I had asked the class to suggest some substance that might be used to induce gustatory dreams and one student had recommended wormwood. A brief discussion followed in which most of the students opposed the selection of wormwood and advocated instead cloves.

Equally interesting were the eight smell dreams. One student dreamed of "smelling and seeing spices." Another "a distinct smell dream of food cooking; can assign no cause, as it was impossible for the odor from the kitchen to reach me." One dreamed of inhaling the fragrance of a cowslip blossom, and she adds that the cowslip had been drawn in school the preceding day. One reports that she dreamed of modelling (in sand) the continent of Asia, and that some sweet-smelling peas grew from the sand. This dream may have been occasioned in part by the fact that she had modelled in sand a relief map of Asia the preceding day, and in part by the planting of some seeds in sawdust a few days before in the science department, in order to study processes of germination.

Several of the more remotely suggested taste dreams were curious. One student, for example, dreamed that the building in which she was sleeping was on fire. She attributes the dream to the last remark which she made to her room-mate before falling asleep: "I shall have to remove this clove; it is burning the mouth out of me."

Comparing the test in the present instance with that previously reported, the following percentages are obtained:

IMAGERY.	TASTE TEST.	VISUAL TEST.
Visual element,	48%	60%
Auditory element,	7%	5%
Motor element,	14%	10%
Gustatory element,	7%	3%
Olfactory element,	3%	1½%

The close relation existing between the taste and smell senses and the comparatively large increase in the percentage of gustatory and olfactory dreams would seem to suggest the peculiar character of the experiment as the cause, especially since several of the dreams involved not merely gustatory and olfactory imagery (*i. e.*, thinking about them), but real tastes and smells. WILL S. MONROE.

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